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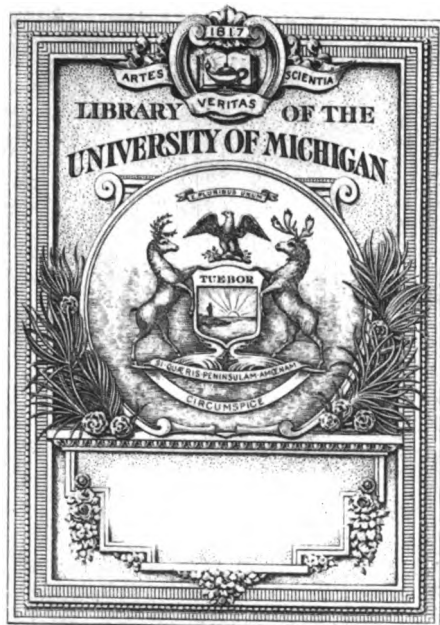
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STATE OF NEW YORK

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FIRST ANNUAL REPORT

OF THE

*New York State*  
*Conservation*  
**CONSERVATION COMMISSION**

1911

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VOLUME II

DIVISION OF INLAND WATERS

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TRANSMITTED TO THE LEGISLATURE JANUARY 10, 1912

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ALBANY  
THE ARGUS COMPANY, PRINTERS  
1912

STATE OF NEW YORK

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CONSERVATION COMMISSION

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JAMES W. FLEMING, Troy ..... } *Commissioners*  
JOHN D. MOORE, New York..... }

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CHARLES H. JACKSON, Albany ..... }  
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EDWIN BAILEY, Patchogue..... }

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ALBERT E. HOYT, Albany ..... *Secretary to Commission*  
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GEORGE P. DECKER, Rochester..... *Assistant Counsel*  
RICHARD W. SHERMAN, Utica..... *Chief Engineer*

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**FIRST ANNUAL REPORT**  
**OF THE**  
**CONSERVATION COMMISSION**

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**DIVISION OF INLAND WATERS**

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ALBANY, N. Y., *January 1, 1912.*

*To the Conservation Commission:*

Herewith I transmit to you, pursuant to the statutory provision, the annual report of the Division of Inland Waters for the fiscal year ending September 30, 1911.

Respectfully yours,

**EDWIN BAILEY,**

*Deputy Commissioner.*



## **DIVISION OF INLAND WATERS**

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**EDWIN BAILEY**.....*Deputy Commissioner*  
**R. W. SHERMAN**.....*Chief Engineer*  
**A. H. PERKINS**.....*Division Engineer*

## REPORT OF THE DIVISION OF INLAND WATERS FOR THE FISCAL YEAR ENDING SEPT. 30, 1911.

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Period covered: The work of the Division of Inland Waters as previously carried on by the State Water Supply Commission was reported upon to December 31, 1910, by that Commission in its Sixth Annual Report. The present report, therefore, covers the period from January 1, 1911, to September 30, 1911. Exception to this is made in the financial statement only.

The work carried on by the Division of Inland Waters is, in a general way, divided under the following heads in the Conservation Law.

- I. Water storage and conservation for power purposes.
- II. Hydraulic Development.
- III. River Improvement.
- IV. Drainage.
- V. Water supply and sewerage.
- VI. Inspection and supervision of Hydraulic Structures.

In this report I and II are united.

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### I. WATER STORAGE AND CONSERVATION FOR POWER PURPOSES AND II. HYDRAULIC DEVELOPMENT.

*General Statement:* Several important events bearing upon the subject of water storage and conservation for power purposes have occurred during the year, and have served to greatly clarify the general situation and to prepare the way for future proper action. The various hearings held by the Commission and the Legislative Committee on conservation have served to greatly extend popular interest and education along these lines. Among the most important of these events may be mentioned the hearings and decisions of the Commission in the Genesee and Hudson River Improvement cases, and the limitation in the scope of the River

Improvement Law made by section 467 of the Conservation Law. This latter feature is of special significance as it definitely ends the attempt to use "public health and safety" as a cloak for what is really water power improvement. It is a gratifying indication of public sentiment regarding our water powers. The way is now open for the treatment of water storage on its own merits, and the Commission has been relieved from an embarrassing position.

Governor Dix's stand on all these questions has been a great aid in progress along proper conservation lines.

#### Hudson River.

On the Hudson River a very considerable amount of survey and investigation work was done under the River Improvement Act. Most of the results will be available for use under whatever proceedings for water storage for power purposes the Legislature may provide in the future. In addition, field and office work have been intermittently continued on a small scale with a view to increasing the available data and putting all into more available shape. Surveys were made of dam sites at Kettle Mountain, below Indian Lake, and on the Cedar River, and a profile of the Upper Hudson and Indian Rivers completed. This profile is shown on Plate I. These projects are described and preliminary estimates given on pages 15-23.

These surveys and studies indicate clearly that owing to the large undeveloped powers on the Hudson above Hadley, which would be made more attractive commercially, and, the low cost of the increased storage taken in connection with its availability to the plants on the Hudson below Hadley, this project should be placed among those immediately practicable and should come before the Schroon and some other projects heretofore considered more desirable.\*

Another potent reason for using Indian Lake to the fullest practicable extent is that having been already used as a regulating reservoir the local inhabitants have become accustomed to such use, and it would not be so difficult to overcome local opposition as might be anticipated in the case of the use of Schroon Lake.

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\*See Table of Reservoir Sites, page 182, Fifth Annual Report of State Water Supply Commission.



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## UPPER SACANDAGA RIVER.

The reason for surveys in this region lies in the existence of considerable amounts of power above the flow line of the proposed Sacandaga Reservoir and below the dams of the proposed Lake Piseco and Lake Pleasant reservoirs, nearly all of which power belongs to the State through its ownership of riparian lands.

Profiles, shown on plate II., were run up the middle and west branches of the Sacandaga river and the power projects shown in Table I. studied.

Table I. shows that if a plant which can run at full capacity 60 per cent. of the time be taken as giving full economic development, the Sacandaga development including the reservoir and a power plant at Hadley will increase the economic power capacity of the Hudson from 126,170 H. P. to 177,780 H. P. at sites now developed and from 44,700 H. P. to 76,650 H. P. at sites now undeveloped or a total gain in economic capacity of the stream at developed and undeveloped sites of 83,560 H. P.

Similarly, after the construction of the Sacandaga reservoir, by the proposed enlargement of the Indian Lake reservoir and its operation for best results for a hydro-electric plant connected with the dam, the economic power of the Hudson will be increased from 177,780 H. P. to 196,290 H. P. at sites now developed, and from 95,670 H. P. to 130,230 H. P. at sites now undeveloped, or a total gain in economic capacity of the stream at developed and undeveloped sites of 53,070 H. P. It should be observed, however, in comparing this figure with the corresponding one for the Sacandaga that only about  $\frac{1}{3}$  of this total is added at sites now developed, while  $\frac{5}{8}$  of the effect of Sacandaga storage is at sites now developed.

Similarly, after the construction of the Sacandaga and Indian river reservoirs, by the proposed Upper Sacandaga reservoirs, the economic capacity of the Sacandaga and Hudson rivers will be increased from 196,290 H. P. to 202,070 H. P. at sites now developed and from 184,690 H. P. to 204,610 H. P. at sites now undeveloped, or a total gain in economic capacity of the rivers at developed and undeveloped sites of 25,700 H. P.

The total gain in economic capacity that will result from the



construction of the Sacandaga, Indian river, Lake Pleasant and Lake Piseco reservoirs, is 162,330 H. P.

*Economic Use of Sacandaga Reservoir.*—There has been a general impression that if power be developed in connection with the dam at Conklingville, the resulting stream regulation will be of greatly diminished value to power users on the Hudson. This subject has been thoroughly studied during the past year, and the point fully elucidated by means of the power percentage of time curves described in last year's report.\* The results of these studies not heretofore published as relating to the Hudson are embodied in Table I. The total economic capacity of the Hudson river below Hadley with economic wheel capacities, i. e., wheels that can run at full capacity 60 per cent. of the time, is 210,850 H. P. if power is developed in connection with the Sacandaga reservoir and 215,150 H. P. if power be not so developed (see Table I opp. page 7).

Figured on the basis of average effect, the total power on the Hudson would be 7,165 H. P. years per year less in the one case than in the other, while the plant in connection with the dam will produce 39,200 H. P. years per year.

*Power Plant in Connection with Sacandaga Reservoir.*—In the preliminary studies made in 1907 and 1908, it was proposed to locate the power house 15,000 feet, measured along the tunnel, below the dam, and to dredge out of the river from the power house to the Hudson a channel 8,500 feet in length and from 10 feet to 40 feet in depth, to serve as a tail-race. Upon further examination it now appears wiser to place the power house at Hadley and tunnel the entire distance. (See Plate III.) The reasons for such a change are:

1. The Sacandaga river will not be completely controlled by the proposed reservoirs, hence it may be expected that there will be times when a considerable volume of water will pass over the spillway. To control and drop this spilled water down the extra 40 feet into the dredged channel from the natural bed of the river will, it is estimated, cost at least \$200,000, which sum must be added to previous estimates.

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\*Sixth Annual Report, State Water Supply Commission, page 120 *et seq.*



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2. The effect of a flood of 25,000 second feet of water passing down the dredged channel would probably be to wash the channel full of debris, causing interruption to service and expense in re-dredging.

3. The cost of the proposed dredging is believed to have been underestimated heretofore, because the borings now available indicate the thickness of the boulder bed to be 20 feet instead of three feet, as assumed in previous estimates, and because of the omission of the item for control of flood waters. Careful comparison of probable costs indicates but small difference between the two methods of development.

4. The greater safety and permanency of an all tunnel line are worth a considerable extra cost if such extra cost should prove to be necessary.

5. The cost of the power house and foundations will be very much decreased by the rock foundations at Hadley.

Convinced of the desirability of locating the power house at Hadley, a survey of the proposed tunnel line was ordered and completed. The surface profile is shown on Plate IV.

*Estimates of cost of power installation at Hadley.*—The solution of the problem of proper capacity of plant installation is a complicated one. Some questions requiring decision are:

1. Shall the auxiliary be designed to carry the peak load or shall the auxiliary run continuously and the water power plant be designed to carry the peak loads?

2. What effect will each method proposed in question (1) have upon the power developments on the river below?

3. What other plants are likely to be combined with the Hadley plant?

4. What will be the probable load factor on the plant?

In answering these questions, the following facts are pertinent:

1. The pondages at Corinth (head 18 feet — electric plant) and Palmer's Falls (head 85 feet — paper mill) are not sufficient to smooth out any large daily fluctuation of stream flow, nor are they sufficiently distant from Hadley for a natural flattening out, but at Spier Falls there is sufficient pondage to allow any degree of rearrangement of daily flow desired.

2. 67.5 per cent. of the power now used on the Hudson is devoted to pulp and paper manufacture, for which a constant stream flow is desirable, but this percentage is almost certain to decrease and the use for electric power generation to increase very greatly in the next twenty years.

3. After the installation of the first 32,000 H. P. which may be operated continuously, additional power can be installed at a cost per H. P. not exceeding \$25.00.

4. Stoppage of a wheel means absolute stoppage of consumption of water, while intermittent operation of steam plant means boilers kept fired up at considerable expense.

5. The growth of demand for power will be gradual.

6. The additional cost of a tunnel of excessive size is not absolute loss because through the saving in power by reduction of friction losses, an appreciable return is made upon the investment.

Having in view all these considerations, it seems clear that the tunnel, and all other features which cannot be readily and cheaply enlarged and do not cost in direct proportion to their size, should be built for a wheel capacity of 90,000 H. P.; that other parts should be built for a present capacity of 32,000 H. P. (the maximum continuous 100 per cent. power); and that provision for ultimate enlargement to 90,000 H. P. capacity should be made at all points.

On this basis the following is the preliminary estimate of cost of power installation at Hadley:

TABLE II.

PRELIMINARY ESTIMATE OF COST OF POWER PLANT IN CONNECTION WITH SACANDAGA RESERVOIR.

Average gross head, 208 ft.

Diameter of tunnel, 26 ft.; area, 530.93 sq. ft.

Length of tunnel, 21,000 ft.

$$\text{Loss of head for 80,000 H. P.} = \begin{cases} 9.9 \text{ ft. in tunnel.} \\ 10 \text{ ft. in gates, etc.} \\ \hline 19.9 \text{ ft.} \end{cases}$$





Velocity for 80,000 H. P. = 9.0 ft. per second.

Velocity for 32,000 H. P. = 3.48 ft. per second.

Loss of head for 32,000 H. P. =  $\left\{ \begin{array}{l} 1.4 \text{ ft. in tunnel.} \\ 3.3 \text{ ft. in gates, etc.} \\ \hline 4.7 \text{ ft.} \end{array} \right.$

(Inlet works of maximum capacity are necessary for the outlet tunnel whether power is installed or not, and are thus chargeable to the storage project. They would be used under more head in the latter case, however, so that an allowance is made chargeable against power development.)

*Wheel Capacity 32,000 H. P.*

Allowance for additional cost of outlet works..	\$20,000 00
21,000 ft. of tunnel at \$175 per ft.....	3,675,000 00
Surge tanks . . . . .	75,000 00
Wheel pits, tail-races and excavations for power house . . . . .	100,000 00
Power and transformer houses.....	55,000 00
All machinery and appliances in power house, including step-up transformers, 32,000 H. P., at \$12 per H. P.....	384,000 00
Land damages . . . . .	20,000 00
Total . . . . .	<hr/> \$4,329,000 00
Engineering, contingencies, and interest and amortization during construction, 15%.....	650,000 00
Total . . . . .	<hr/> <hr/> \$4,979,000 00



TABLE III.

## SACANDAGA POWER PLANT.

*Wheel Capacity, 90,000 H. P.*

Estimate of cost of plant:

*Data.*

H. P. Yrs. of hydraulic power available, stream regulated by Sacandaga reservoir only.....	40,000
H. P. capacity of auxiliary required.....	9,000
H. P. Yrs. required from auxiliary, average year..	1,000
Development proposed, hydraulic .....	90,000
Development proposed, auxiliary.....	10,000
Auxiliary plant to be located in Albany: Power from it delivered in Albany.....	10,000
Efficiencies, transformers 98%	
dynamos 95%	
transmission 90%	
Total, turbine shafts to low tension bus bars, Albany 82%	
Amount of 12-hour power that can be delivered in Albany from hydraulic plant.....	65,000
Total ultimate average output 12 hours .....	70,000

*Estimate.*

Allowance for cost of outlet works additional to that necessary for storage uses .....	\$40,000
21,000 ft. of 26-foot tunnel, at \$175 per ft.....	3,675,000
Surge tanks .....	225,000
Wheel pits, tail race and excavation for power house .....	300,000
Power and transformer houses.....	160,000
Water wheels, dynamos, switches, step-up transformers, instruments, etc.....	1,080,000
Land damages .....	20,000
Auxiliary plant 10,000 H. P.....	600,000
	<hr/>
	\$6,100,000





Engineering and contingencies, 10% .....	\$610,000
	<hr/>
	\$6,710,000
Interest, 3½% during construction (1 year) .....	235,000
Amortization (1 year) .....	53,000
	<hr/>
Total .....	\$6,998,000
	<hr/> <hr/>

It is apparent from these figures that the steam auxiliary should be at most no more than sufficient to supplement the water power so as to make possible an economic use of the reservoir, taking into consideration the long term variations of stream flow, and this is still true after transmission costs have been taken into account.

Examination of the surveys of tunnel line and power house site, will permit more accurate estimates, but final figures cannot be arrived at until proper borings have been made.

TABLE IV.

## PRODUCTION COSTS OF POWER PLACED ON HIGH TENSION LINES.

	State Operation.	Private Operation.
Operating expenses, including admin- istration, maintenance and repairs to station and equipment .....	\$120,000	\$120,000
Maintenance and repairs to tunnel and outlet works .....	40,000	40,000
Depreciation, 2% on \$4,375,000 .....	87,000	87,000
Depreciation, 4% on \$2,000,000 .....	80,000	80,000
Interest, 3½% State; 5% corporation ..	245,000	350,000
Amortization, State 50-year 3½% basis; corporation 50-year 5% basis.	53,000	33,000
Storage charges .....	70,000	70,000
Taxes and insurance .....	40,000	40,000
Operating costs of steam auxiliary not already accounted for at 0.4 cents per H. P. hour .....	90,000	90,000
	<hr/>	<hr/>
Total .....	\$825,000	\$910,000
	<hr/> <hr/>	<hr/> <hr/>

TABLE V.  
TRANSMISSION LINE AND SUB-STATIONS.

<i>Data.</i>	
Length, miles .....	50
Power delivered, H. P. ....	65,000
Voltage at beginning of line .....	110,000
Voltage at end of line .....	100,000
<hr/>	
<i>Estimate.</i>	
625,000 lbs. of copper, at 20c. ....	\$125,000
500 towers, at \$200 .....	100,000
3,000 insulators, at \$8 .....	24,000
4 sub-stations with interswitching apparatus, lightning arresters, transformers, etc. ....	455,000
Telephone line .....	20,000
	<hr/>
	\$724,000
Engineering and contingencies, 20% .....	145,000
	<hr/>
	\$869,000
Interest, 1 year, 3½% .....	30,000
Amortization, 1 year .....	7,000
	<hr/>
Total cost, exclusive of right of way .....	\$906,000
	<hr/>

TABLE VI.  
OPERATION OF TRANSMISSION LINES — Cost, \$900,000.

	State Operation.	Private Operation.
Interest, 3½% State; 5% corporation..	\$32,000	\$45,000
Depreciation:		
2% on \$600,000 .....	12,000	12,000
1% on \$300,000 .....	3,000	3,000
Taxes and insurance 1% .....	9,000	9,000
Maintenance and repairs:		
2% on \$400,000 .....	8,000	8,000
1% on \$200,000 .....	2,000	2,000



**WATER STORAGE — HUDSON SYSTEM.**  
**Dam Site of Proposed Cedar River Reservoir.**



**WATER STORAGE — HUDSON SYSTEM.**  
**Basin of Proposed Cedar River Reservoir.**





Superintendence, patrol, sub-station operation, administration, etc.....	\$25,000	\$25,000
Amortization:		
State 50-year 3½% basis.....	7,000	
Corporation 50-year 5% basis.....		4,000
Total .....	<u>\$98,000</u>	<u>\$108,000</u>

TABLE VII.

TOTAL YEARLY COST TO DELIVER IN ALBANY IN BULK 70,000  
H. P. OF 12-HOUR POWER.

	State Operation.	Private Operation.
Cost of production .....	\$825,000	\$910,000
Cost of transmission and transforma- tion .....	98,000	108,000
Total .....	<u>\$923,000</u>	<u>\$1,018,000</u>
Cost per horse-power .....	\$13 19	\$14 54
Cost per horse-power after allowances explained below .....	<u>16 00</u>	<u>18 00</u>

The market for the power from the Sacandaga development would be a matter of growth and development. Part of the plant could be put in as required. A proper provision for the future would, however, require that a considerable amount of capital should be put in ahead of actual requirements. To provide for fixed charges on this non-productive capital and to allow for fixed charges on cost of right-of-way, the above costs would have to be increased somewhat — say, to \$16 and \$18 respectively.

#### Cedar River — Indian River Storage Project.

The present Indian Lake reservoir, built in 1898, has a storage capacity between high and low water of 4.6 billion cubic feet, and a tributary drainage area of 129 square miles = 35.7 million cubic feet per square mile. It is proposed to increase the capacity of this reservoir by raising the flow line from 1650 to 1660 and turning Cedar river into the new reservoir, thus obtaining a total



storage of 11.6 billion cubic feet, with a total tributary drainage area of 291 square miles or 40 million cubic feet per square mile. The dam on Indian river is to be built at a point about one and one half miles up stream from its confluence with the Hudson. The Cedar river dam is to be located opposite Bullhead Pond. Table VIII exhibits the general facts relative to these proposed dams.

It will be noted that the storage costs are \$5.49 per H. P. year of power added by storage to the capacity of the stream. The corresponding figure for the Sacandaga reservoir is \$5.72, but the greater portion of such power from the Sacandaga reservoir will be added to developed sites, while only one fifth of the power from the Indian river reservoir would be added at developed sites. This addition to undeveloped powers would encourage their development and utilization. The stored water would increase the total economic development at developed sites by 18,500 H. P., and at undeveloped sites by 34,600 H. P. a total of 53,100 H. P.

Estimates of capital and operating costs of the reservoir are given in Tables IX and X. See Plate V for general plan.

TABLE VIII.

	Indian River Dam.	Cedar River Dam.
Elevation of crest.....	1660	1675
Elevation of flow line.....	1660	1670
Extreme height of dam above river bed, feet .....	140	188
Drainage area, square miles.....	197	94
Capacity of reservoir, billion cu. ft.....	11.2	0.4
Estimated cost of reservoir.....	\$1,618,000	\$87,000
Cost of 7 billion cubic feet of additional storage..		\$1,705,000
Cost per million cubic feet .....		\$243.60
<hr/>		
Addition to economic development at developed sites .....		18,500 H. P.
Addition to economic development at undeveloped sites .....		34,600 H. P.
<hr/>		
Total .....		53,100 H. P.
Mean regulated flow from reservoir.....		700 C. F. S.





TABLE IX.

## OPERATING COSTS OF INDIAN AND CEDAR RIVER RESERVOIRS.

*Capital Cost — \$1,705,000.*

Interest at 3½ per cent.....	\$60,000
Amortization (3½ per cent 50 yr. basis).....	13,000
Taxes . . . . .	15,000
Depreciation and repairs.....	5,000
Superintendence and labor.....	5,000
Administration . . . . .	1,000
<hr/>	
Total . . . . .	\$89,000
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Say . . . . .	\$90,000
Total H.P. yrs. per year available from stored water	16,391
Storage cost per H. P. yr. of added power.....	\$5.49

**Indian River and Kettle Mountain Power Projects.**

*General Statement.*— The Indian river project contemplates a power plant at the junction of the Indian and Hudson rivers, receiving water through a pressure tunnel 15 feet in diameter and 1.5 miles long from the Indian river reservoir. The average working head would be about 210 feet. An installation of 35,000 H. P. turbine capacity is contemplated.

The Kettle Mountain project contemplates a power plant on the Hudson about one half mile below the mouth of the Boreas river. Water is to be brought through a pressure tunnel 2.6 miles long and 17 feet in diameter from the dam on the Hudson at the foot of Kettle mountain. The dam is to be 188 feet high from the present surface of the water to the spillway crest. It will back the water up to the tail water elevation of the Indian river project. An installation of 70,000 H. P. is projected.

Tables X to XVI give data and estimates of capital and operating costs of these plants.

Plate V shows the general plan.

**Costs of Power from Indian River and Kettle Mountain Projects — Kettle Mountain Development.**

TABLE X.

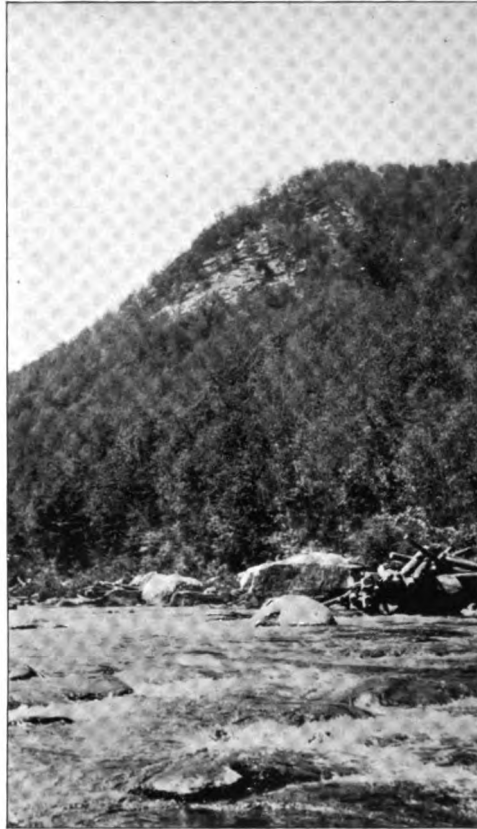
## ESTIMATE OF COST OF PLANT.

*Data.*

H. P. yrs. of hydraulic power available, stream regulated for Indian river.....	30,000
H. P. capacity of auxiliary required.....	13,000
H. P. yrs. required from auxiliary, average year..	2,500
Development proposed, Hydraulic.....	70,000
Auxiliary .....	20,000
Auxiliary plant to be located in Albany. Power delivered in Albany from it.....	10,000
Efficiencies, transformers 98%	
dynamoes 95%	
transmission 90%	
Total from turbine shafts to low tension bus bars, Albany 82%	
Amount of 12-hour power that can be delivered in Albany from hydraulic plant.....	50,000
Total ultimate average output 12-hour power.....	55,000

*Estimate.*

Dam, spillways and headworks.....	\$3,000,000
Tunnel 14,000 ft. long, 17 ft. diameter at \$100 per lin. ft. ....	1,400,000
Surge tanks .....	200,000
Wheel pits, excavations for power house, power and transformer houses .....	400,000
Water wheels, dynamoes, switches, transformers, instruments, etc. ....	1,050,000
Auxiliary plant complete.....	1,200,000
Total .....	<hr/> \$7,250,000



HYDRAULIC DEVELOPMENT — HUDSON SYSTEM.  
North End Kettle Mountain Dam Site.



HYDRAULIC DEVELOPMENT — HUDSON SYSTEM.  
Kettle Mountain Dam Site.





Engineering and contingencies, 10%.....	\$725,000
Interest 1 year, 3½%.....	280,000
Amortization 1 year, (3½% basis).....	65,000
Total . . . . .	<u>\$8,320,000</u>

TABLE XI.

TOTAL PRODUCTION COSTS OF POWER PLACED ON HIGH TENSION LINES.

*Capital Investment, \$8,320,000.*

	State operation.	Private operation.
Operating expenses of hydraulic plant including administration, maintenance and repairs to station and equipment . . . . .	\$90,000	\$90,000
Maintenance and repairs to tunnel and outlet works . . . . .	44,000	44,000
Depreciation, 2% on \$5,000,000.....	100,000	100,000
4% on \$3,320,000.....	133,000	133,000
Interest:		
State, 3½% . . . . .	291,000	
Private operation, 5%.....		416,000
Amortization:		
State, 3½%, 50-year basis.....	63,000	
Private, 5%, 50-year basis.....		40,000
Storage charges . . . . .	22,000	22,000
Taxes and insurance.....	60,000	60,000
Operating costs of steam auxiliary not already accounted for; 5,000 H. P. of 12-hour power at \$17.50 per year . . . . .	88,000	88,000
	<u>\$891,000</u>	<u>\$993,000</u>



## Indian River Development.

TABLE XII.

*Data.*

H. P. years of hydraulic power available.....	14,000
H. P. capacity of auxiliary required.....	3,600
H. P. years required from auxiliary.....	1,100
Development proposed, hydraulic.....	35,000
auxiliary .....	5,000
Auxiliary plant to be located in Albany. Power from it delivered in Albany.....	5,000
EFFICIENCIES SAME AS IN TABLE X.	
Amount of 12-hour power that can be delivered in Albany from hydraulic plant.....	23,000
Total ultimate average output of 12-hour power...	25,000

*Estimate.*

Extra cost of outlet works chargeable to power...	\$20,000
Tunnel, 8,000 lin. ft., 15 ft. diam., at \$86 per ft..	688,000
Surge tanks .....	75,000
Wheel pits, excavation for tail races, power and transformer houses, etc.....	175,000
Water wheels, dynamos, switches, transformers, instruments .....	525,000
Auxiliary plant .....	300,000
	<hr/>
	\$1,783,000
Engineering and contingencies, 10%.....	178,000
Interest 1 year 3½%.....	70,000
Amortization 1 year (3½% basis).....	15,000
	<hr/>
	\$2,046,000



**HYDRAULIC DEVELOPMENT — HUDSON SYSTEM.**  
 Dam Site on Sacandaga River One Mile Below Junction of West Branch.



**WATER STORAGE — HUDSON SYSTEM.**  
 Dam Site of Proposed Enlarged Indian Lake Reservoir.





TABLE XIII.  
ESTIMATE OF PRODUCTION COSTS OF POWER PLACED ON HIGH  
TENSION LINES.

*Capital Cost of Plant, \$2,000,000.*

	State operation.	Private operation.
Operating expenses of hydraulic plant including administration, maintenance and repairs to station and equipment . . . . .	\$65,000	\$65,000
Maintenance and repairs to tunnel and outlet works . . . . .	7,000	7,000
Depreciation 2% on \$1,000,000 . . . . .	20,000	20,000
4% on 1,000,000 . . . . .	40,000	40,000
Interest:		
State, 3½% . . . . .	70,000	
Private, 5½% . . . . .		100,000
Amortization:		
State, 3½%, 50-year basis . . . . .	15,000	
Private, 5%, 50-year basis . . . . .		10,000
Storage charges . . . . .	13,000	13,000
Taxes and insurance . . . . .	15,000	15,000
Operating costs of steam auxiliary not already accounted for, 2,000 H. P. of 12-hour power at \$17.50 per year..	35,000	35,000
	<hr/> \$280,000	<hr/> \$305,000
	<hr/>	<hr/>

Cost of Transmission of Power from Kettle Mountain and Indian  
River Plants to Albany.

TABLE XIV.  
CAPITAL COSTS OF TRANSMISSION.

<i>Data.</i>	
Power to be delivered H. P. . . . .	73,000
Length of transmission, miles . . . . .	100
Voltage at beginning of line . . . . .	110,000
Voltage at end of line . . . . .	100,000

*Estimate.*

Copper, 2,500,000 lbs., at 20¢.....	\$500,000
1,000 towers, at \$300.....	300,000
6,000 insulators, at \$8.....	48,000
4 sub-stations with interswitching apparatus, lighting arresters, transformers, etc.....	438,000
Telephone lines .....	40,000
	<hr/>
	\$1,326,000
Engineering and contingencies, 20%.....	265,000
Interest 1 year, at 3½%.....	56,000
Amortization 1 year, (3½% basis).....	13,000
	<hr/>
Total capital cost exclusive of right of way..	\$1,660,000
	<hr/> <hr/>

TABLE XV.

## OPERATING COSTS OF TRANSMISSION LINE.

*Capital Cost, \$1,700,000.*

	State operation.	Private operation.
Interest 3½% State, 5% Private.....	\$60,000	\$85,000
Depreciation 2% on \$1,000,000.....	20,000	20,000
1% on 700,000.....	7,000	7,000
Taxes and insurance .....	17,000	17,000
Maintenance and repairs:		
2% on \$800,000.....	16,000	16,000
1% on \$500,000.....	5,000	5,000
Superintendence, patrol, substation operation, administration, etc.....	25,000	25,000
Amortization:		
State 50-year, 3½% basis.....	13,000	.....
Private 50-year, 5% basis.....	.....	8,000
	<hr/>	<hr/>
Total .....	\$163,000	\$183,000
	<hr/> <hr/>	<hr/> <hr/>

TABLE XVI.

TOTAL YEARLY COSTS TO DELIVER IN ALBANY IN BULK 80,000  
HORSEPOWER OF 12-HOUR POWER.

	State operation.	Private operation
Cost of production:		
Kettle Mountain .....	\$891,000	\$993,000
Indian River .....	280,000	305,000
Cost of transmission and transforma- tion .....	163,000	183,000
 Total .....	 \$1,334,000	 \$1,481,000
Cost per Horsepower.....	16.68	18.51
Cost after allowance for growth of market .....	19.00	22.00

**Genesee River.**

Aside from the proceedings under the River Improvement Act, there has been little further development of the situation on the Genesee. Several points remain for study, however. Previous reports have given estimates of costs of power development in connection with the storage dam with power-house, at what is designated as site "B" (see map opposite page 158 of Progress Report of 1908). Site "B" requires  $3\frac{1}{2}$  miles of tunnel; site "A," only  $1\frac{1}{4}$  miles. The average gross head available at site "A" is 435 feet; at site "B," 506 feet. In connection with either development, a dam in the gorge just above Mt. Morris will make available a total gross head of 610 feet from storage reservoir to last tail water. In the case of development at site "A" this dam would be 150 feet high. In the case of development at site "B" it would be about 80 feet high. A study of costs indicates that taking into consideration value of power lost in friction in the long tunnel, the total costs of power production would differ but little in the two cases. The short tunnel has, however, the decided advantage of allowing a smaller initial investment for the first small plant, without sacrifice of future possibilities when de-

mands for power require greater installation. (See Plate VI for general plan.)

The development at site "A" is therefore recommended.

*Economic use of Portage Reservoir.*— By means of the power percentage of time curves the effect on benefits to Rochester power arising from the development of power in connection with the Portage dam has been studied. Table XVII embodies the principal results of these studies. The total horsepower years available at Rochester from the Genesee river within economic wheel capacities is 33,904 per year if power is developed in connection with the Portage dam, and 38,960 per year if power be not developed at Portage. The loss to the riparian owners is thus 5,000 horsepower years, while the plants in connection with the storage dam and in the Mount Morris gorge will produce 52,175 horsepower years.

The economic plant capacity of the river at Rochester, at present 27,712 horsepower, will be 36,340 horsepower with the storage reservoir used for best results at a plant below the dam and 42,080 horsepower if the water be used for best effects at Rochester, the difference being 5,740 horsepower.







TABLE XVII.  
STATE OF NEW YORK, CONSERVATION COMMISSION, DIVISION OF INLAND WATERS, SUMMARY OF EFFECTS OF  
STORAGE ON THE GENESEE RIVER UPON THE DEVELOPED AND UNDEVELOPED WATER POWER.

LOCATION.	Drainage area.	PRESENT CONDITIONS.									
		PRESENT DAM.		PRESENT INSTALLATION.							
		Elevation of crest.	Working head, Feet.	Rated H. P. of turbines.	Minimum monthly flow of unregu- lated stream c. f. s.	H. P. available with flow stated in column VI at 80% Eff.	H. P. years available from water in average year.	H. P. of steam auxiliary.	H. P. capacity of turbines for 24 hour continuous operation 60% of average year.	H. P. years avail- able from water in average year with capacity given in column X.	
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	
Rochester	2,365	502.0	228.6	29,220	291	6,053	22,656	*31,687	27,712	22,141	
York.....	1,619	527.6	4.8	.....	130	.....	.....	.....	427	325	
Genesee.....	1,473	536.2	8.2	100	127	65	98	65	700	530	
Mt. Morris.....	1,070	579.9	15.0 to 17.7	390	89	134	356	300	990	760	
Portage.....	948	1,096.5	7.5	142	81	55	134	320	380	300	
Totals.....	.....	.....	265.1	29,852	.....	6,307	23,244	32,372	30,209	24,056	

\* Includes 7,000 electric H. P. from Niagara.

TABLE No. XVII — (Concluded).

CONDITIONS AFTER REGULATION FOR PORTAGE WITH 13.4 B. C. F. AT PROPOSED PORTAGE RESERVOIR.											
LOCATION.	H. P. years per year added within present wheel capacity from storage.	Elevation proposed crest of dam.	Ultimate working head. Feet.	Minimum monthly regulated flow c. f. s.	H. P. capacity of turbines for 24 hour continuous power 60% of average year.	Load factor of plant.	Gross H. P. of turbines operating 60% of time at stated load factor.	H. P. years available from water with capacity given in column XVI	Additional power afforded by river regulation after economic development. H. P. years per annum.	AUXILIARY POWER Required.	
										Rated H. P.	H. P. years per annum.
	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII
Rochester.....	4,986	511.6	242.5	1,180	36,340	62	58,500	33,904	6,871	10,510	2,397
York.....	.....	527.6	4.8	1,025	670	750	1,300	620	160	220	50
Gene co.....	2	536.2	8.2	1,020	1,110	50	2,220	1,030	270	350	80
Mt. Morris.....	34	{ 579.9	18.0	990	2,030	50	4,060	1,955	630	420	75
Portage.....	8	{ 733.0	150.0	820	17,000	60	34,000	16,375	5,225	3,500	625
		{ 1,212.0	425.0		36,800		61,300	35,800	10,800	5,200	1,000
Totals.....	.....	.....	848.5	.....	93,950	.....	161,380	89,684	23,956	20,200	4,227
REGULATION FOR ROCHESTER.											
Rochester.....	5,170	511.6	242.5	1,240	42,080	62	68,000	38,960	8,430	14,786	3,120



Interest during construction .....	\$123,000
Amortization during construction .....	28,000
	<hr/>
Total .....	\$3,638,000
	<hr/>

TABLE XIX.

## TOTAL PRODUCTION COSTS OF POWER PLACED ON HIGH TENSION LINES.

	State operation. Private operation.	
Operating expenses, including admin- istration, maintenance and repairs to station and equipment .....	\$108,000	\$108,000
Maintenance and repairs to tunnel and outlet works .....	10,000	10,000
Depreciation, 2% on \$1,600,000.....	32,000	32,000
4% on \$2,000,000.....	80,000	80,000
Interest:		
3½% State .....	127,000	.....
5% Private . . . . .	.....	182,000
Amortization:		
State 3½% 50-yr. basis.....	28,000	.....
Private 5% 50-year basis .....	.....	17,000
Storage charges .....	135,000	135,000
Taxes and insurance .....	25,000	25,000
Operating costs of steam auxiliary power not already accounted for at 0.4¢. per H. P. hour.....	70,000	70,000
	<hr/>	<hr/>
Total .....	\$615,000	\$659,000
	<hr/>	<hr/>

TABLE XX.

## TRANSMISSION LINE AND SUB-STATION.

*Data.*

Length, miles .....	44
Power delivered, H. P.....	59,000
Voltage at Portage.....	110,000
Voltage at Rochester.....	100,000

*Estimate.*

422,000 lbs. of copper at 20¢.....	\$84,000
440 towers at \$200 .....	88,000
2,640 insulators at \$8.....	21,000
2 sub-stations complete with interswitching apparatus, lightning arresters, transformers, etc..	354,000
Telephone line .....	18,000
Engineering and contingencies, 20%.....	113,000
Interest, 1 yr. 3½%.....	24,000
Amortization, 1 yr.....	5,000
Total, exclusive of right of way.....	<u>\$707,000</u>

TABLE XXI.

## OPERATION OF TRANSMISSION LINE.

*Cost, \$710,000*

	State operation.	Private operation.
Interest: 3½% State, 5% Private.....	\$25,000	\$35,000
Depreciation, 2% on \$500,000.....	10,000	10,000
1% on \$200,000 .....	2,000	2,000
Taxes and insurance, 1%.....	7,000	7,000
Maintenance and repairs:		
2% on \$350,000 .....	7,000	7,000
1% on \$200,000 .....	2,000	2,000
Superintendence, patrol, sub-station, labor, administration of line, etc...	15,000	15,000
Amortization:		
State, 3½% 50 yr. basis.....	5,000	.....
Private, 5% 50 yr. basis.....	.....	3,000
Total . . . . .	<u>\$73,000</u>	<u>\$81,000</u>

TABLE XXII.

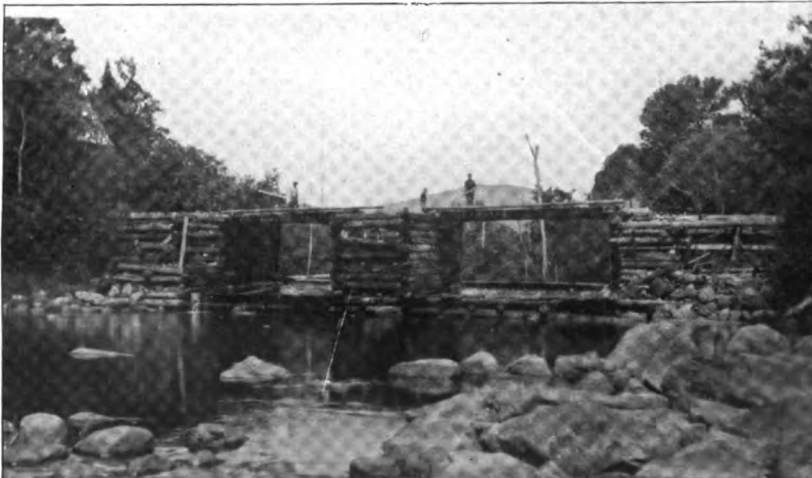
TOTAL YEARLY COST TO DELIVER IN ROCHESTER IN BULK 63,000  
H. P. OF 12-HOUR POWER.

	State operation.	Private operation
Cost of production .....	\$615,000	\$659,000
Cost of transmission and transforma- tion .....	73,000	81,000
Total .....	<u>\$688,000</u>	<u>\$740,000</u>
Cost per horse power.....	\$10.92	\$11.73
Cost after allowance for fixed charges on cost of right of way and growth of market . . . . .	<u>\$13.00</u>	<u>\$15.00</u>

*Surplus Canal Waters.*—Section 400 of the Conservation Law provides for the lease by the Commission of privileges to use the surplus water of the canals of the State whenever the Superintendent of Public Works shall certify to the existence of such surplus waters, at points to be designated by him. The Barge canal engineers place the aggregate at 50,000 horsepower. Previous to the passage of the Conservation Act no authority existed for the study of this subject by the State Water Supply Commission, canal waters having been specifically excluded in the Fuller Act of 1907. At this writing the subject of power development from surplus canal waters is being gone over and studied at length by the Conservation Commission and information on this subject will be given in the next annual report.

*Present Reservoir System.*—A comprehensive study of the present reservoir systems on the different rivers of the State, covering ownership, history, uses and value for different purposes, is in progress.

On the Black river there is an extensive system of reservoirs built to supply the Black river and Erie canals and to compensate power owners for waters diverted to the canals. This system is being carefully studied and the facts determined as to whether



HYDRAULIC DEVELOPMENT — HUDSON SYSTEM.  
Dam Site at Auger Flats, Lake Pleasant and Sacandaga Lake Reservoirs.







the power owners have been sufficiently compensated or over-compensated. Such a study involves the history as well as the engineering features of this matter.

*Fourth Lake Reservoir.*—Complaint was made to the Commission that the water was being drawn down on this reservoir to the great inconvenience of navigation and of the owners of summer residences on the shores of the lakes. Commissioner Moore made a trip to this region in August and after conference with the power owners and shore owners it was proposed that the water should not be drawn below the crest of the dam at Old Forge until after September 15th, but that thereafter it should be available to power owners below on the Moose and Black rivers. This compromise was acceded to by both the representatives of the shore owners and power owners. The very great use of the shores of these lakes for summer residences that have been established since the creation of the reservoir has made it expedient to give heed to the shore owners and navigation interests, although these latter uses arose at a period considerably subsequent to the construction of the reservoir and probably are largely due to such construction, and hence legal rights will need to be carefully weighed. At any rate, the mutual forbearance shown during 1911 by the two opposed interests made possible the solution proposed by Commissioner Moore and is undoubtedly wisely shown on the part of each.

*General Summary of State Owned Powers.*—Table XXIII gives a general summary of the powers existing in New York State in which the State has an interest, or will doubtless have an interest through proposed works and grants from the national government. It is not intended to list here all the powers to which the State may lay claim.

TABLE XXIII.

*Hydraulic Power Owned by State.*

	H. P.	H. P.
1. Canal Waters:		
(a) Barge canal powers.....	65,000	
(b) Power that may belong to State by asserting its rights where damages have been paid in the construction of the Erie canal, etc., esti- mated at .....	20,000	
Sub total .....		85,000
2. Water power created at or near site of reservoirs constructed to regu- late stream flow:		
(a) Portage reservoir, Genesee river .....	39,000	
(b) Sacandaga reservoir, Hudson river .....	42,000	
(c) Black river reservoir.....	3,000	
Sub total .....		84,000
3. Water powers belonging to State through its ownership of river beds, banks, or riparian rights:		
(a) Kettle mountain .....	28,500	
(b) Sacandaga river above Northville .....	31,200	
(c) Ausable river .....	10,000	
(d) Indian river .....	14,000	
(e) Raquette river .....	10,000	
Sub total .....		93,700
Total .....		262,700





TABLE XXIV.

POWERS CREATED BY STREAM REGULATION AT WATER POWER  
SITES PRIVATELY OWNED.

	H. P.	H. P.
1. At power sites now undeveloped:		
(a) Hudson river .....	*20,000	
(b) Genesee river .....	9,000	
(c) Black river .....	5,300	
(d) Raquette river .....	29,300	
(e) Oswegatchie river .....	5,000	
	<hr/>	
Sub total .....		68,600
2. At power sites now developed:		
(a) Hudson river .....	*75,900	
(b) Genesee river .....	10,000	
(c) Black river .....	25,000	
(d) Raquette river .....	9,400	
(e) Oswegatchie river .....	7,000	
	<hr/>	
Sub total .....		127,300
		<hr/>
Total .....		195,900
		<hr/> <hr/>

\*Based on stream flows regulated by Sacandaga reservoir (28.8 B. C. F.) plus Indian lake reservoir (11.6 B. C. F.) plus two reservoirs on the Upper Sacandaga (5.6 B. C. F.)

TABLE XXV.

UNDEVELOPED POWERS CLAIMED TO BE PRIVATELY OWNED  
THROUGH RIPARIAN RIGHTS OR LEGISLATIVE GRANTS.

	H. P.
1. St. Lawrence river, Long Sault.....	500,000
2. Niagara river, 4,400 C. F. S. at Falls.....	75,000
3. Niagara river rapids.....	145,000
4. Upper Hudson .....	83,000

	H. P.
5. Raquette river .....	77,200
6. Genesee river .....	8,000
Total .....	888,200

TABLE XXVI.

SUMMARY OF LARGE UNDEVELOPED POWERS AND ADDITIONS TO  
POWERS NOW DEVELOPED. FROM TABLES XXIII, XXIV  
AND XXV.

Canal waters .....	85,000
Storage reservoir powers .....	84,000
Riparian rights unquestionably owned by State..	93,700
Powers created by stream flow regulation.....	195,900
Large undeveloped powers claimed by private owners .....	888,200
Grand total .....	1,346,800

*Value of a Horsepower Produced from Stored Water.*—Various estimates of the value of storage reservoirs to the powers benefited have been made and various methods of determining the value of benefits derived have been proposed. Previous to the last report of the State Water Supply Commission, the extent of benefit in any case had been given as the amount of power added by storage to the low water flow of the stream, and the value of horsepower on this basis was roughly assumed at \$5 per horsepower per year. Thus on the Hudson the total of maximum power to be added by the Sacandaga reservoir at the time of lowest stream flow in an average year to the powers between Hadley and Troy was figured at 85,000 horsepower, and the value at \$425,000 per year.

The limitations of this method of calculation were recognized all along and in the last year's report a new method of determination of benefits by means of the power percentage of time curve was briefly described. By this method the number of horsepower years added within economic wheel capacities to the power producing value of the stream by a storage reservoir is taken as the true and proper measure of the benefits to power derived from a



**WATER STORAGE — HUDSON SYSTEM.**  
**Dam Site — Proposed Lake Pleasant Reservoir.**



**WATER STORAGE — HUDSON SYSTEM.**  
**Shore View of Proposed Lake Pleasant Reservoir.**  
**Note Swampy Shores to be Flooded.**







storage reservoir. Thus on the Hudson the benefits to powers between Hadley and Troy to be added in an average year by the Sacandaga reservoir measured in this way are figured as 30,000 horsepower years. Manifestly, if \$5 per year per horsepower was a fair figure for the value measured on the former basis, a much larger figure is fair when the other basis is used in figuring the horsepower. In other words, the resulting horsepower obtained by the two methods are expressed in entirely different units.

The first is a maximum amount, all of which is available through only a very small portion of the year. The second is an average of the power furnished at different rates during the year but figured as though spread evenly throughout the entire year. The \$5 per year was simply an expression of the judgment of the engineer as to the value of the power furnished measured by the unit chosen by him. The second method of determining benefits is more precise, and permits of a more exact determination of the value of such benefits per unit installed. Where the power proposed to be furnished by stored water is now produced by steam or other auxiliary, or where there is a definite market value for the sale of power, the value of power from stored water can be readily determined for any particular plant.

There are cases, however, where neither of these conditions exists. For instance, in the pulp industry, it is claimed that pulp cannot be profitably ground with steam power, and as a matter of fact steam auxiliary is not often installed in connection with pulp manufacture. This is partly due to the cheapness with which wheels and machinery can be installed for using the high water flows to grind pulp which is stored until needed or until better market prices rule. Where this is carried too far, however, the interest and depreciation on plant and interest on value of raw or finished materials in storage, together with the storage costs, aggregate more than the cost of auxiliary steam power sufficient for continuous operation.

What each power user considers to be the value to him of water power is very clearly indicated, even though he has no auxiliary, by the capital he has invested, in plant and stored products taken in connection with the length of time that the plant can run at full capacity, and the return that private capital usually considers

necessary upon money so invested. If, in the opinion of the power owner, the last horsepower of complete plant installed would not, in running the small portion of the year that it can run, i. e., during high water, produce a satisfactory return upon the total investment in plant operated by that horsepower then the investment would not have been made — he would have installed a smaller plant. Accordingly there is in each plant indisputable evidence of what was the owner's idea of the value of a horsepower year of power at the time he made his last addition to his wheel capacity.

Suppose that a pulp manufacturer has just completed an addition of 500 horsepower of water wheel capacity, and that the new wheel, wheel pits, housings and grinders, and other machinery, and buildings, all combined cost him \$50 per horsepower capacity. Assume this 500 horsepower is added capacity to an old plant of 10,000 horsepower for which the river furnished sufficient power to operate at full capacity 52 per cent. of the time in an average year. The river will then furnish power to the new portion of the plant something less than 52 per cent. of the time, say 50 per cent. of the time. Then this part of the plant will produce the same amount of pulp that 250 horsepower operated the entire year would produce. If this power owner is satisfied with a return of 17 per cent. upon the investment to cover interest, depreciation, repairs and business profit, then for these items the cost to him of the 250 horsepower years produced by the new power is 17 per cent. upon the investment of \$25,000 or \$4,250, or \$17 per horsepower year. To this sum must be added the interest upon money invested in pulp stored during high water for use or sale during low water, the cost of placing the stored pulp in storage and taking it out, and rent of storage grounds.

If half the pulp produced by the addition is stored half the time the interest on the capital invested in stored pulp reckoned at 6 per cent. amounts to about \$1.50 per year per horsepower year. The cost of loading, carting, piling, reloading, carting and unloading five tons of pulp (the product of 1 horsepower year) will be about \$6.25. As only half the pulp from the portion of output obtained from the last 500 horsepower installed is stored,

this portion of the charge is \$3.12 per horsepower year. The total value of a horsepower year from storage water under the conditions presupposed is thus  $\$17 + \$1.50 + \$3.12 = \$21.62$ . Other items of expense might be mentioned which though important cannot readily be given a value. Among these are inefficiency of labor due to lack of continuity of operation; increased daily wage made necessary by enforced idleness during part of the year, the total yearly wage being determined largely by the least yearly sum that will keep the wage earner in the condition of life to which he is accustomed, whether that amount be earned by working for six months or whether it be earned by working throughout the whole year.

CLASSIFIED STATEMENT OF EXPENDITURES FOR WATER POWER  
AND WATER STORAGE SURVEYS AND INVESTIGATIONS UNDER  
CHAPTER 569, LAWS OF 1907 (FULLER ACT), SEPTEMBER 30,  
1910-SEPTEMBER 30, 1911.

1910.

*Receipts.*

Sept. 30. Unexpended balance of appropriation. \$40,108 35

*Disbursements.*

Salaries of engineering force .....	\$22,610 26
Office rent and equipment.	553 67
Maintenance expenses of engineering force.....	440 97
Traveling and sundry expenses of engineers....	707 59
Livery and boat hire....	82 00
Engineering supplies ...	513 18
Maps, blue prints and photographs . . . . .	54 58
Rental and purchase of instruments . . . . .	111 81
Stream gaging in co-operation with U. S. Geological Survey .....	7,056 32

Rain gaging .....	\$392 42	
Printing and stationery.	1,555 53	
Telegraph, telephone, freight, expressage, etc.	720 51	
		<hr/>
		\$34,800 84
Balance September 30, 1911.....	\$5,307 51	<hr/>

### III.—RIVER IMPROVEMENT.

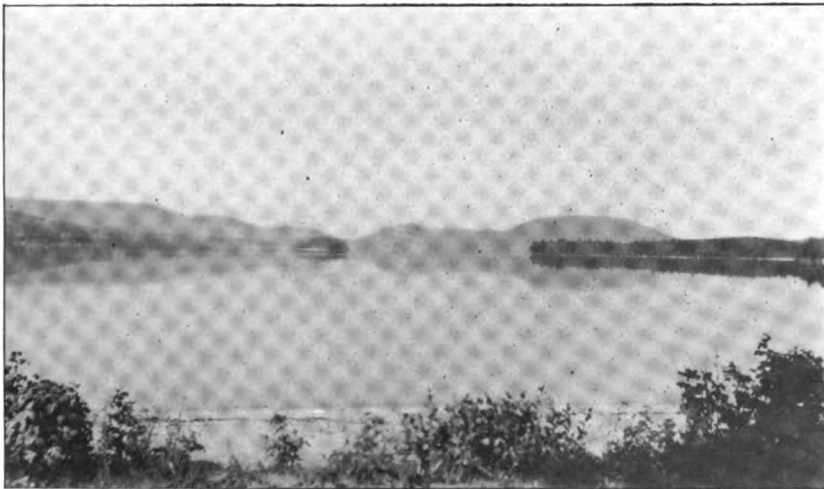
There were, during the past year, several very important developments relating to the River Improvement Law. These were the Sutherland decision in the Canaseraga creek improvement matter, the hearings and decisions in the matters of the Hudson and Genesee river improvements and the new limitation of the scope of the law made in section 467 of the Conservation Law. As previously stated, this latter event is considered of great significance in removing the possibility of using river improvement as a cloak for power improvement.

As shown by the financial statement, a very considerable amount of the time of our small engineering force was occupied in the work of surveying, preparing plans, etc., for filing under the river improvement act. Most of the money thus spent has been used to good advantage because the data gathered will be used in any procedure that may be had in the future for securing stream regulation.

*Hudson River.*—At the beginning of the calendar year 1911, the completion of the maps, plans, profiles and estimates for the regulation of the Hudson by means of the Sacandaga reservoir under the River Improvement Law, following the petition of the City of Albany et al., was under way. These plans, etc., were completed and adopted by the Commission on February 21, 1911, and filed in the office of the Commission and in the County Clerk's office in the counties of Hamilton, Fulton, Saratoga, Washington, Rensselaer, Albany and Warren. Hearings were had during the month of April and on May 16th the plans, etc., were amended and a final decision and order were entered in the matter. A bill was drafted providing for the approval of the



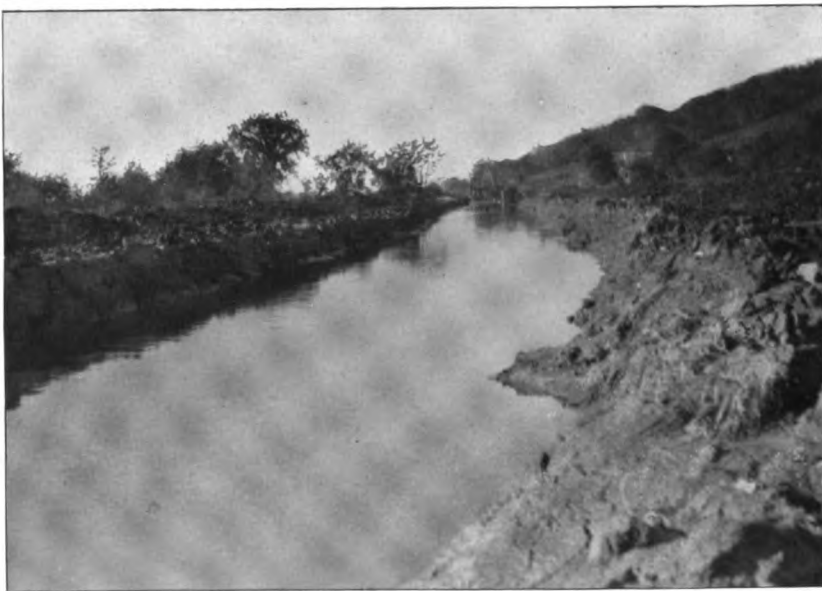
**WATER STORAGE — HUDSON SYSTEM.  
Lake Pleasant Shore Line.**



**WATER STORAGE — HUDSON SYSTEM.  
Lake Pleasant.**







RIVER IMPROVEMENT — CANASERAGA CREEK.  
View of Dredged Channel.







final order by the Legislature, and the whole forwarded to the Legislature. The bill, however, failed of passage. The full text of the decision and bill are given in Assembly Document No. 53 of 1911. The dissenting opinion of Commissioners Acker and Persons is given in Appendix "B" of this report. This opinion is here brought forward in support of the statements made below in the discussion of the Genesee and Hudson decisions.

*Genesee River.*—At the time of the last report on this matter plans, profiles, estimates, specifications, etc., had been filed and hearings set. During February and March hearings were had. A decision was not made, however, until June 16th, when the application was denied. The memorandum accompanying this decision is given in Appendix "C."

*Discussion of Genesee and Hudson River Improvement Decisions.*—These decisions clearly show the embarrassing position in which the State Water Supply Commission was placed in regard to the procedure under the River Improvement Law. Under the terms of the Fuller Law (chapter 569 of the Laws of 1907) they had been directed "to devise plans for the progressive development of the water powers of the State for the public use under State ownership and control," and to draft a bill therefor. Extensive investigations had been carried on under this law, and a bill drafted. The Commission was in this manner definitely committed to the plan of a State revenue from water storage projects in proportion to benefits conferred. Cases involving water storage for power purposes had been, therefore, prejudged. As stated in the Genesee decision, the Commission could not free itself from the spirit of the Fuller bill and their work thereunder, nor from the public sentiment of the time as their work under the Fuller Act had disclosed it to them. In partial response to this sentiment, the Legislature has, as previously stated, relieved the Conservation Commission from possible embarrassment of the nature indicated.

\* *Canaseraga Creek.*—At the beginning of the calendar year of 1911 the contractor for the improvement of Canaseraga creek, DeWitt C. Stephens, had the parts of a two cubic yard dipper

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\* For report to December 31, 1910, see Sixth Annual Report of State Water Supply Commission, page 102; Fifth Annual Report, page 144; Fourth Annual Report, page 118.

dredge on the ground and was erecting it. As noted in previous reports, certiorari proceedings had been begun in May, 1910, by the trustees of the Bingham estate and John M. Hastings to review the proceedings of the State Water Supply Commission and to have the lands of the Bingham estate and Hastings excluded from the improvement district. Decision by Judge Sutherland was handed down January 4, 1911. This opinion is to the effect that the State Water Supply Commission exceeded its statutory authority by including in its ordered construction artificial channels, thus grafting upon the river improvement scheme a drainage scheme, and therefore "for the reason that any assessment made by the defendant Commission will be void if levied to pay for the drainage work under the plan outlined, the prayer of the petitioner must be granted, and his land must be exonerated from such assessment."

As the effect of such a decision, if sustained by higher courts, would be to destroy the security for the bonds previously sold, the State Water Supply Commission shortly after January 11, 1911, when the decision was filed, ordered stopped all expenditures payable from the Canaseraga creek improvement fund, withdrew its engineers, sent a copy of the decision to the attorney for the purchasers of the bonds, notified the contractor of the decision, and ordered the attorney for the Commission to discontinue the procuring of the right-of-way and to apply for a rehearing.

The landholders of the improvement district immediately became very active to secure a continuance of the work. After consultation with the Commission a form of contract was devised wherein the landowners agreed that they would not contest any action of the Commission in carrying out the law on any grounds except inequality of assessment, and the signatures of the owners of 64 per cent. of the property within the previously defined district was secured. At the same time a bill was introduced in the Legislature so amending the River Improvement Law that upon the filing of such an agreement in the County Clerk's office the land affected "shall nevertheless constitute and become a part of such improvement district and shall be legally liable to assessment and taxation, etc." This bill became a law May 17th, and the work was immediately ordered to proceed.



RIVER IMPROVEMENT — CANASERAGA CREEK.  
Present Channel at Pioneer Road Bridge.



RIVER IMPROVEMENT — CANASERAGA CREEK.  
General View of Dredged Channel.





The attorney for the Commission was authorized to employ three landowners to assist in procuring the right-of-way. This committee, with the aid of the resident engineer of the Commission, secured about half the right-of-way before its dissolution.

The contractor began work at the crossing of the Dansville and Mount Morris railroad and proceeded down stream. On September 30th he had reached a point 8,400 feet from the starting point, and had excavated 54,000 cubic yards of material. At the same time the masonry for the bridges was proceeding and on September 30th the abutments for three farm crossings had been completed and another started.

*Dry River Improvement (Watervliet).*—On March 28, 1911, an application was filed with the State Water Supply Commission by the riparian owners along Dry river in Watervliet asking for the improvement of Dry river for the benefit of public health and safety.

The Legislature having passed a bill authorizing the city of Watervliet to issue bonds to the extent of \$200,000 to construct the work as a municipal undertaking, the Commission on August 18th voted to abandon proceedings in this matter.

*River Improvement at Local Expense.*—Chapter 284 of the Laws of 1909 gave the Commission jurisdiction over the improvement of water courses at local expense. Under the provisions of this act the Village of Tupper Lake filed a petition on July 19, 1909, for the construction of a dam on the Raquette river at Settingpole rapids. The project was described in the Fourth Annual Report of the State Water Supply Commission.

On April 21, 1911, the modified court order relating to the Litchfield injunction was filed by James L. Jacobs, but there have been no further developments, the petitioners having so far failed to deposit the funds required by statute for the execution of this work.

CLASSIFIED STATEMENT OF EXPENDITURES FOR SURVEYS AND INVESTIGATIONS UNDER STATE BOARDS AND COMMISSIONS LAW.  
OCTOBER 1, 1910—SEPTEMBER 30, 1911.

1910. *Receipts.*

Oct. 1. Unexpended balance of appropriation under chapter 513, Laws of 1910. \$19,452 27

1911.

July 28. Appropriation by Supply Bill, chapter 811, Laws of 1911 ..... 30,000 00  


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\$49,452 27

*Disbursements.*

Salaries of engineering force ..... \$10,909 97  
Traveling and sundry expenses of engineers.... 1,902 79  
Office rent and equipment. 415 17  
Livery hire..... 37 50  
Telephone and expressage. 69 55  
Publication ..... 75 00  


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\$13,409 98

Balance September 30, 1911..... \$36,042 29  


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CLASSIFIED STATEMENT OF EXPENDITURES FROM CANASERAGA CREEK IMPROVEMENT FUND, SEPTEMBER 8, 1910, TO SEPTEMBER 30, 1911.

1910. *Receipts.*

Sept. 8. Proceeds of bonds.....\$208,093 33  
Dec. 31. Interest on fund..... 1,923 18

1911.

March 31. Interest on fund..... 1,443 44  
July 1. Interest on fund ..... 1,487 21  


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\$212,947 16

*Disbursements.*

Office equipment and ex-	
penses . . . . .	\$454 01
Engineering and legal	
services . . . . .	9,242 36
Traveling expenses . . . . .	1,325 93
Interest on bonds . . . . .	10,000 00
Construction . . . . .	2,701 79
Printing . . . . .	686 60
	<hr/>
	\$24,410 69
Balance September 30, 1911 . . . . .	\$188,536 47
	<hr/>

IV.—DRAINAGE.

The State has had drainage laws since its formation and considerable work has been done under such laws, but the result has been almost universal failure. Almost every swamp of any magnitude has through it one or more abandoned "Commissioners' ditches." The aggregate of sums thus spent is very considerable and the results wholly incommensurate therewith. If we look for the reason for this almost universal condition we shall find it in the methods prescribed by the law for carrying on the work. Heretofore, these laws provided that the work should be done by commissioners appointed by the judge of the County Court where the work is located. These appointees were always local men unused to the conduct of engineering matters, unused to securing and using competent technical advice, and frequently incapable of taking the large view of the problems involved. Business failure under such circumstances is to be expected. The provisions for drainage contained in the Conservation Law are designed to overcome these defects of procedure. The organization of the Conservation Commission is believed to be well fitted to overcome previous defects and hence it is expected that there will eventually result from the present law the reclamation of a considerable part of the 270,000 acres of swamp land in the State and an addition of at least \$15,000,000 to farm land values of the State. There has been but little done to develop this feature of our work.



In June last a reconnaissance was made of Wallkill swamp, situated in Orange county. See Plate VII. This reconnaissance disclosed a very promising project for the reclamation of 2,000 acres of muck land and reduction of flood effects. The following is quoted from the report submitted:

“In reporting upon the engineering features found, attention should first be called to the bifurcation of the stream about one-half mile south of the Pellett's Island crossing. The branch passing along the foot of Snake Hill and near Denton and New Hampton is the natural course of the stream. Some time about forty years ago (I could not readily ascertain the exact date) a small ditch was cut through along where the other branch now flows. The stream has enlarged this artificial channel until all the low water flows therein and by far the greater portion of the floods. In the artificial channel in the length viewed by us there are two gravel and boulder riffles, one short one of perhaps five feet fall, about  $\frac{3}{8}$  of a mile south of the Denton crossing and another of perhaps three feet fall and 500 feet long midway between the Denton and Erie crossings. These riffles have limited the depth of stream cutting. Any dredging at these points would, it is believed, be quickly followed by stream cutting to full depth in the rest of the channel and increase in slope. In the old bed, rock outcrops in the stream bed between Denton and New Hampton.

“Floods on the stream are frequent and of great violence. From the statements of the inhabitants, I should say that conditions are very similar to those occurring on the Canaseraga. The increasing depth of the artificial outlet has probably in the past mitigated them slightly, but there are evidences of yearly spring floods covering practically the entire valley, and the inhabitants state that in case of fall floods cattle and crops are swept away. These fall floods are said to occur once in four years on the average.

“The soil is composed principally of muck underlaid with a thick bed of clay. Where cleared, it is used principally for lettuce, celery and onions. There are immense areas, however, used for pasture and hay.





"Another obvious aid in securing the prompt discharge of the floods would be the straightening of the channel and increase in sectional area somewhat in the manner shown.

"It was stated that numerous plans for securing relief from floods had been broached, and attempts to secure legislation made. There seemed to be a general feeling also that something should be done.

"There is another problem to be considered in connection with floods. It is well known that muck lands when dry are very poor producers. It was stated that in dry seasons the onion and celery crops suffer very severely, and are sometimes abandoned. Any drainage system should, therefore, provide means for handling the ground water levels as desired. This can readily be accomplished, owing to the very slight fall in the stream. Bear trap dams at one or two points would meet the conditions perfectly, and the area to be benefited is so great that the cost would not prove burdensome."

(See recommendations at the close of this report.)

## V.—WATER SUPPLY AND SEWERAGE.

*Westchester County Water Famine.*—The preliminary report on this subject contained in the preceding report of this division was followed by further office studies. These studies indicate clearly that a supply of water sufficient for the needs of the southern part of Westchester county for many years to come could be obtained from the Oscawana lake and Popolopen creek watersheds, and that the probable cost of delivering this water to the various watersheds would be very much less than the price which is now charged to them by New York city.

The present water supply situation in this locality is portentous of public calamity, and lack of proper co-operation is all that stands in the way of effective steps for permanent relief. Water for domestic purposes was carried through the streets in milk cans and sprinkling carts in the city of Mt. Vernon and various small villages in the fall of 1910. Extremely opportune fall rains were all that prevented a recurrence of the same conditions in 1911.

Each of the various municipalities is engaged in endeavoring to solve its own small problem, and naturally finds no solution for more than a very limited period, while the rapid growth in the population of the region makes a large general and permanent solution more and more imperative. The economic waste due to lack of unity of purpose will be apparent. This would not be so serious a matter if results looking to a final solution of any considerable part of the question were being obtained. Even if annexation to New York city were finally consummated, the utilization of the water resources of Oscawana lake and other parts of the watershed of Peekskill creek would still be desirable from a conservation standpoint.

For a complete list of water supply applications and recent decisions see Appendix "D."

#### WATER SUPPLY APPLICATIONS JANUARY 1, 1911—SEPTEMBER 30, 1911.

Number	Applicant	Application filed	Disposition
93.....	Village of Avoca.....	Jan. 25, 1911	Approved Feb. 10, 1911
94.....	Westbury Water District....	Feb. 21, 1911	Approved April 7, 1911
95.....	Weedsport Water Co.....	Mar. 1, 1911	Approved Mar. 22, 1911
96.....	City of Gloversville.....	April 26, 1911	Approved June 16, 1911
97.....	Village of Cornwall.....	May 24, 1911	Approved June 6, 1911
98.....	City of Cortland.....	June 17, 1911	Approved July 11, 1911
99.....	Castle Heights Water Co....	July 6, 1911	Approved Sept. 25, 1911
100.....	Village of Mexico.....	Aug. 12, 1911	Pending
101.....	New York City, Borough of Richmond.....	Sept. 12, 1911	Pending
102.....	New York City, Borough of Brooklyn.....	Sept. 12, 1911	Pending
103.....	Manhasset-Lakeville Water District.....	Oct. 24, 1911	Pending

#### RECOMMENDATIONS FOR FUTURE WORK.

1. Power surveys and storage reservoir investigations on the Black, Oswegatchie, Raquette and other rivers, and the Canada creeks.

2. Surveys of the enlarged Indian lake and the Cedar river reservoirs.

3. Reconnaissances of the more important drainage projects.

4. Complete surveys of one or more promising drainage projects.

5. Studies of engineering, economic, legal and political aspects of the distribution and use of State owned power, and undeveloped privately owned power.

6. Systematic research, gathering, classifying and cataloging of history and engineering facts relating to State owned property, paying especial attention to putting all data in such shape that it will be readily available.

7. Sub-surface investigations in the vicinity of Conklingville in connection with the Sacandaga reservoir.

8. Sub-surface investigations along the proposed tunnel line for power development at Hadley from the Sacandaga reservoir.

9. Hydrographic work.

#### VI.—INSPECTION OF DOCKS AND DAMS.

The dams in the State are generally in a very neglected condition, even those which originally were well constructed. The responsibility and the danger of impounding waters behind insufficient barriers is generally not recognized. Many dams were built when the surrounding country was entirely unsettled and property of little value. But the same types of dams have been continued in use in many places where they are no longer safe under existing conditions. This applies to many of the wooden dams which are loosely built and not anchored nor filled with stones, and were originally built for logging purposes. Also to many narrow earth dams and to earth dams without a spillway or with only a narrow wood sluiceway. It was also found that there were earth dams with a thin masonry core, on which the down stream half of the dam, the half which resists the pressure of the impounded water, is omitted.

The safety of an earth dam is in its never overflowing. A spillway acts for an earth dam as a safety valve on a boiler. Every earth dam should have a masonry spillway with sufficient unobstructed area to take the highest flow. The earth dam should be built high enough above the highest flow, so that even with a flood at high water the dam cannot overflow. And the dam should be built above the highest wave action and above the frost line.

From October 10 to November 30, 1911, there were inspected and reported upon the following forty-six dams in the State:

(a) Eight wooden crib dams, mostly ten to twenty feet in height. Six of these are filled with stone and two unfilled. One abandoned dam, the reservoir of which was filled with water and

in bad condition, was ordered emptied. For two entire rebuilding was recommended and the rest required repairing.

(b) Nineteen earth dams, mostly twenty to forty-five feet in height, two of which are in process of construction. Eleven have no spillways to protect the earth dam and one had the spillway obstructed. The case of one which was in very bad repair was referred to counsel to place responsibility. On one work was stopped on account of improper construction. The water was lowered in eight reservoirs from four to ten feet in order to bring the dams within safe limits. One was emptied on account of weakness. For six, repairs and alterations were recommended.

(c) Sixteen solid masonry dams, mostly ten to sixty-four feet in height, five of which are in progress of construction. Two of these were ordered emptied,—one on account of poor masonry, cracks and leaks, and one on account of thin walls. Water was lowered in one in order to make the dam safe. Three were leaking badly and ordered repaired, and for six repairs were recommended.

(d) Three buttressed reinforced concrete dams, six, seven and thirty feet in height respectively. One was in good condition, one in fair and for one minor changes were recommended.

The repairs and improvements recommended for the above thirty-eight dams are generally being carried out, or will be in the spring when the weather permits, and this work will be followed up to see that it is properly done. Every effort will be made to improve the condition of the dams in the State and to bring them up to the best standards.

#### AUSTIN, PA., DAM.

As the investigation of this Commission on the failure of the Austin, Pa., dam supplied the earliest explanation of the failure of that structure there has been considerable demand for its complete publication. Subsequent testimony has corroborated the report, which is as follows:

On October 11th last an inspection was made of the remains of the dam at Austin, Pa., owned by the Bayless Pulp & Paper Company of Binghamton, N. Y. The Commission might well have examined this dam and site in order to demonstrate the im-

portance of this work, for the washing out of the dam has left ruin and desolation in its track, and shows most emphatically the need of State supervision for all such works in the interest of the surrounding community.

This dam was built of concrete in which large stones were embedded. It was 40 feet high, 544 feet long,  $2\frac{1}{2}$  feet wide on top and supposed to be 30 feet wide at the base. It was completed December 1, 1909, and filled January 21, 1910. Two days later a section slid out some 18 inches at the base, and water in large quantities came through the ground below the dam. The reservoir was then emptied, a short section at the top two feet deep having been blown out by dynamite in an attempt to hasten its discharge. A month afterward, without any strengthening whatsoever, the dam was refilled as high to the breach made by the dynamite. At this time there was a leakage under the dam of 600 gallons per minute. And on September 30th last the dam gave way completely.

The failure was principally due to the dam not being properly bonded to the foundation rock bed beneath, and so it slid forward under the pressure of the water impounded, aided by water leakage under the dam.

The engineer's plans, as published, show the concrete of the dam running down into a channel cut from the rock foundation bed, four feet deep and four feet wide, for the entire length of the dam. But on the up-turned section of the dam now lying in the river, there was no evidence of any such wall having been built into the rock. As far as could be seen from this section, and from the east remaining section, which has moved but little, the dam was simply placed on top of the rock bed and not let into it anywhere.

The only anchor was  $1\frac{1}{4}$  inch rods every two feet nine inches along the up-stream face. And these were absolutely of no use, because by the time they had been stretched so as to act, the whole dam was in motion, and nothing could have stopped it. Dams should be built heavy enough to resist all possible opposing forces without depending upon steel reinforcement which cannot be brought into action until the masonry has failed.



Other defects were as follows:

The seams in the rock bed above the dam were not all cleaned out and grouted, thus leaving easy access to water under the dam. The dam was built much too light, that is not thick enough; the top thickness was but  $2\frac{1}{2}$  feet, and it should have been at least 4 feet, and 5 feet would have been better; and the bottom width, shown on the published plans as 30 feet, measures on the east remaining section mentioned above only 20 feet. The spillway was rather small, being but 4 feet by 50 feet for a drainage area of 25 square miles. Many of the rocks imbedded in the concrete in the dam were of soft sand-stone, slate, talc and other laminated rocks easily sheared in one direction and laid so as to offer little resistance to horizontal shearing; one large section was broken off, splitting the rocks.

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## **APPENDIX A.**

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### **PROGRESS REPORT ON HYDROGRAPHIC WORK CARRIED ON IN CO-OPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY.**

**By C. C. COVERT, District Engineer, U. S. Geological Survey.**



# PROGRESS REPORT ON HYDROGRAPHIC WORK CARRIED ON IN CO-OPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY.

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## LETTER OF TRANSMITTAL.

ALBANY, N. Y., Feb. 9, 1912.

HON. GEO. E. VANKENNEN, *Chairman, State of New York Conservation  
Commission, Albany, N. Y.:*

DEAR SIR.—I have the honor to submit herewith the report on co-operative stream gaging work, carried on under my direction, between the United States Geological Survey and the Conservation Commission during the year ending December 31, 1911.

I have been assisted in this work by Mr. W. G. Hoyt, Assistant Engineer, Mr. C. S. DeGolyer, Mr. G. H. Canfield, Mr. Francis Weber, Junior Engineers, and Mr. W. A. James, Clerk, all of the United States Geological Survey, Albany office; also in revision of the 1910 ice estimates and computations of the 1911 data by Mr. R. H. Bolster, Hydraulic Engineer, and other members of the computing section of the Water Resources Branch, United States Geological Survey, at Washington, D. C.

Special acknowledgments of assistance rendered in field and office, are due also to Mr. John D. Moore, Commissioner of Inland Waters, and to the engineers of that department; to officers of the United States Weather Bureau for climatological data and to power companies and individuals, who have furnished data herein contained.

Very truly yours,

C. C. COVERT,  
*District Engineer.*



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## PROGRESS REPORT ON HYDROGRAPHIC WORK CARRIED ON IN CO-OPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY.

### PROGRESS OF WORK.

The co-operative stream flow investigations begun in 1907, as a result of the passing of the Fuller bill, first covered six stations in the Upper Hudson drainage basin. The surveys and investigations that developed the extensive storage possibilities in this and other drainage basins, made it necessary to obtain additional data concerning the discharge of the various streams under consideration, before designs for storage reservoirs could be completed. These data are necessary for use not only in connection with the construction and operation of storage reservoirs, but also in relation to the building of dams and the development of water power by individuals, if the state is to have control over such enterprises. In order to make the work comprehensive and the data efficient, men trained for such work should be employed, and the investigations should be planned and executed in a manner that will make the records comparable with those obtained in other parts of the country. These results are attained most readily when the records are gathered under the direct supervision of the Federal Government. The recognition of these facts by those in authority has resulted in the continuation and expansion of the co-operative work between the Survey and the various states. Increased State appropriations in New York State have made it possible to enlarge the scope of the work, until at present, records are being obtained from twenty-eight stream gaging stations representing nearly all the important drainage basins, and eighteen rain-fall stations, principally in the Adirondack mountain region.

Rarely does the attempt to enlarge or expand scientific investigations suddenly meet with entire success. Some errors of judgment are bound to enter. Especially is this true of stream gaging work, where so many unforeseen conditions arise due to the very great difference between the high and low water flow and the influence of local conditions, such as back water due to ice and log jams. One, of necessity, must have the stream under consideration for a period covering the variations of flow, before he can, with discrimination, establish a gaging station. This cannot always be done, however, and it therefore becomes necessary to establish the stations at what appears to be a favorable site and await developments. Such a condition has existed in the New York State work, but gradually we are weeding out the poor stations, supplanting them with stations of better location and equipping them with the most modern appliances known in stream gaging practice.

During 1911, the station on Sacandaga river at Northville was discontinued on account of inability to secure reliable gage heights and the fact that the station would be within affect of back water from the Conklingville dam when completed. The station at Wells was abandoned on account of back water conditions caused by the construction of a dam just below. A new station was established on Sacandaga river at Hope to replace the Northville and



Wells stations. Another new station was established at Blackbridge on the West Branch of the Sacandaga in order that the discharge of this stream might be determined. The records obtained at Blackbridge will be used in connection with those obtained at Hope in determining the run-off of the Sacandaga above the confluence of the West Branch. Other new stations were installed as follows:

Cedar river near Indian lake.

Middle Branch, Moose river at Old Forge.

Black river at Boonville.

Salmon river at Stillwater.

Orwell creek near Altmar.

In connection with some of these new stations, stay wires have been installed, which make it possible to apply the two point method to all discharge measurements. Heretofore high water measurements have been made by the subsurface velocity method with the application of a co-efficient, determined by vertical velocity curves, to reduce the velocity thus obtained to a mean velocity. It is proposed during the coming year to provide other current meter stations with stay wires, in order that the true rating curve may be developed and that the rating curve already in use may be verified.

The problems connected with the obtaining of dependable stream flow data are greater in New York State and in New England than they are in almost any other part of the country, because so many of the streams are affected by power development and storage, and the channels, through the winter months, are affected by ice, and through the spring by logging conditions. On streams controlled by power and storage, the wide variations between morning and evening gage readings tend to indicate that these data do not fairly represent the mean gage height for a twenty-four hour period. The fluctuations in the daily stage are undoubtedly the chief contributing cause of the wide variations in the estimated monthly discharge of various stations on the same stream, especially where the data are obtained at current meter stations. In order, therefore, actually to obtain mean daily gage heights at any station, a continuous twenty-four hour record is necessary, but it is practically impossible to obtain such a record with a staff or chain gage equipment.

The advanced stage of the studies made for storage on the Sacandaga and Genesee rivers developed the fact that it was imperative that continuous twenty-four hour records be obtained. Therefore, recording gages were installed on the Sacandaga near Hadley and on the Genesee at St. Helena and at Rochester. The stations at Hadley and St. Helena are so located, that they will determine not only the amount of water being discharged at approximately the site of the proposed dams, prior to their construction, but they will also show the discharge from these storage reservoirs after they are completed, and will furnish the data upon which charges may be made for the use of water. It is also expected that results obtained from these gages will assist in placing a value upon the former method of obtaining the discharge at these stations.

The Genesee and the Sacandaga are not under artificial control to any extent at present, and therefore the records do not fairly represent the average stream flow conditions in New York State. However, if we take daily periods covering flashy floods on these streams, it can readily be shown that one

or two readings a day may be subject to as much as 80 per cent. of error. Just how much the records computed from one or two gage readings a day will tend to compensate in a year's record, cannot be determined, because we have not sufficient records for continuous twenty-four hour periods to afford a basis of comparison. But even though, through a year, the records should compensate, they are not accurate enough for the problems at hand, because we have entered upon an era of development in the use of water, that places a different valuation upon this natural resource, and if the Commonwealth is to construct storage reservoirs, that will actually conserve, the records must have a degree of accuracy that will warrant the undertaking of developments well within the margin of variation shown by the present records.

*Recommendations.*

While there has been considerable progress in the hydrometric work in New York State, there are still a number of important streams for which no records are available. There are other streams of less importance, where records have been obtained for one or two seasons, and these records in the near future may well be dropped to be resumed from time to time, when climatic or local conditions make it desirable.

In order that the hydrometric work may assume a more definite relation to the development and conservation of the State's water resources, we should have what may be termed *base stations* in all important drainage basins. These stations should be located near the center of the power zone of each basin and at places where they would not be destroyed by future developments, and where the points of control would be permanent. Each should be equipped with recording gage, with cable and car, if necessary, and with stay wire. Such stations should be completely rated and a continuous twenty-four hour record of their discharge should be maintained indefinitely. Secondary stations should be established on the important tributaries in each basin and carried through a period of from one to five years, the time depending upon the relative importance of the streams.

The installation and maintenance of these base and secondary stations would furnish data that would enable the Conservation Commission to pass, with a far greater degree of accuracy, upon applications for permission to develop any water power or municipal supply. This fact justifies the large initial expense in establishing the base stations.

*Co-operative Gaging Stations Maintained in 1911.*

The co-operative agreement between the United States Geological Survey and the State Water Supply Commission has been continued by the State of New York Conservation Commission and the following funds are available for the stream gaging and rain fall studies for the fiscal year ending September 30, 1912:

State of New York Conservation Commission.....	\$10,000
United States Geological Survey .....	1,000
	<hr/>
Total . . . . .	\$11,000
	<hr/>

In addition to this fund there is an appropriation from the State Engineer's department of \$1,500 and a like appropriation from the United States Geological Survey, making a total of \$3,000 which fund is used principally on streams in the southern part of the State at stations that have been maintained for a number of years under co-operative agreement with the State Engineer.

The continuation of the \$10,000 appropriation has made it possible to materially increase the number of stations from which daily estimates of discharge are published. In the report for 1910 such estimates were given for 17 stations; for the year 1911 these data are available for 21 stations, an increase of 24 per cent. Three recording gages are in successful operation and three of the rain-fall stations have been equipped with tubes and scales by the U. S. Weather Bureau for the purpose of more accurately determining the water equivalent of accumulated snow.

*Gaging Stations Maintained in 1911.*

- Hudson river at North Creek, September 21, 1907-1911.
- Hudson river at Thurman, September 22, 1907-1911.
- Hudson river at Mechanicville, December, 1888-1911.
- Cedar river near Indian Lake, July 15, to December 31, 1911.
- Indian lake reservoir at Indian Lake, July 22, 1900-1911.
- Schroon lake at Pottersville, July 8, 1908-1911.
- Schroon river at Riverbank, September 23, 1907-1911.
- Sacandaga river at Wells, August 26, 1907-1911.
- Sacandaga river near Hope, September 15, to December 31, 1911.
- <sup>a</sup> Sacandaga river at Northville, August 26, 1907-1910.
- <sup>a</sup> Sacandaga river at upper bridge near Hadley, September 13, 1907-1910.
- Sacandaga river cable station near Hadley, November 12, 1910-1911.
- Sacandaga river, Union Bag and Paper Company's mill at Hadley, September 24, 1909-1911.
- West Branch Sacandaga river at Blackbridge, March 14, to December 31, 1911.
- Cattaraugus creek at Versailles, September 23, 1910-1911.
- Genesee river at St. Helena, August 14, 1908-1911.
- Genesee river at Jones' Bridge, near Mount Morris, May 22, 1903-1906, 1908-1911.
- Genesee river at Elmwood avenue, Rochester, February 9, 1904-1911.
- Canaseraga creek at Dansville, July 21, 1910-1911.
- Canaseraga creek at Shakers Crossing.
- Keshequa creek at Sonyea, July 22, 1910-1911.
- Salmon river at Stillwater bridge, near Redfield, June 24, to December 31, 1911.
- Salmon river at Fox's bridge, near Pulaski, September 5, 1900, to December 6, 1908, July 14, 1910-1911.
- Orwell creek near Altmar, June 23, to December 31, 1911.
- Black river near Boonville, February 16, to December 31, 1911.
- Moose river at Moose River, June 5, 1900-1911.
- Middle Branch Moose river at Old Forge, November 8, to December 31, 1911.
- Oswegatchie river near Ogdensburg, May 16, 1903-1911.

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<sup>a</sup> Data revised for 1911 Report.

Raquette river at Raquette Falls, near Coreys, August 27, 1908-1911.  
 Raquette river at Piercefield, August 20, 1908-1911.  
 Raquette river at Massena Springs, September 21, 1903-1911.  
 Bog river near Tupper Lake, August 24, 1908-1911.  
 St. Regis river at Brasher Center, August 22, 1910-1911.  
 Ausable river at Ausable Forks, August 27, 1910-1911.

LIST OF RAINFALL AND TEMPERATURE STATIONS MAINTAINED  
 DURING THE YEAR 1911.

STATION.	County.	Observer.	Established.
Forked Lake.....	Hamilton.....	R. J. Dunning.....	Sept. —, 1907
Keepawa.....	Hamilton.....	L. W. Brown.....	Sept. —, 1907
Morehouseville.....	Hamilton.....	Theo. C. Remonda.....	Sept. —, 1907
North Creek.....	Warren.....	W. G. Kenwell.....	Sept. —, 1907
Old Forge.....	Herkimer.....	Mrs. S. W. Nelson.....	Dec. 16, 1907
Potsdam.....	St. Lawrence.....	A. E. Sutherland.....	Dec. 4, 1907*
Blue Ridge.....	Essex.....	L. D. Aiken.....	Nov. 9, 1910
Tupper Lake.....	Franklin.....	Santa Clara Lumber Co..	Nov. 5, 1910
Horseshoe.....	St. Lawrence.....	W. R. Partridge.....	Nov. 4, 1910
Knowelhurst.....	Warren.....	D. S. Austin.....	Nov. 2, 1910
Northville.....	Fulton.....	E. E. Parke.....	Aug. 22, 1910
Wakely Dam.....	Hamilton.....	Frank Pelon.....	Dec. 11, 1910
Wanakana.....	St. Lawrence.....	J. Otto Hamel.....	Apr. 15, 1910
Wards Creek.....	Franklin.....	Mrs. Frank Eldred.....	Nov. 5, 1910
Wells.....	Hamilton.....	Vernon E. Dewey.....	Dec. 21, 1910
Altmar.....	Oswego.....	Byron Helm.....	May 22, 1911
Bennett Bridge.....	Oswego.....	Mrs. G. J. Stevens.....	May 16, 1911
Boonville.....	Oneida.....	W. D. Charbonneau.....	Feb. 16, 1911
Hooker.....	Lewis.....	John Denning.....	May 19, 1911
Leisher Mills.....	Lewis.....	H. N. Schrader.....	May 18, 1911
Littlejohn Settlement..	Oswego.....	Mrs. Michael Donahue...	May 19, 1911
Newcomb.....	Essex.....	Edward Spain.....	Nov. 10, 1910
North Osceola.....	Lewis.....	Elmer A. Durst.....	May 17, 1911
Otto Mills.....	Oswego.....	Arza Clark.....	May 19, 1911
Pulaski.....	Oswego.....	Seymour J. Fox.....	May 15, 1911
Redfield.....	Oswego.....	W. G. Simmons.....	May 17, 1911
Rome.....	Oneida.....	John O'Mara.....	Nov. 1, 1910
Smartville.....	Oswego.....	F. O. De Long.....	May 16, 1911
Stillwater.....	Oswego.....	C. A. Hall.....	Nov. 15, 1911

\* Records available 1823-1848, 1889-1897, 1903-1908.

*Accuracy and Reliability of Field Data.*

Practically all discharge measurements made under fair conditions are within 5 per cent. of the true discharge at the time of observation. Generally speaking, the errors in meter measurements are largely compensating; therefore the mean rating curve, when well defined, is considered much more accurate than the individual measurements.

The work is, of course, largely dependent upon the reliability of the observers. With but few exceptions the observers perform their work honestly. The observations are made twice daily—morning and evening. While these do not always give the mean height for that day, these errors also are com-

pensating and can be considered as negligible for a period of one month, on uncontrolled streams, although a single day's reading may, when taken by itself, be considerably in error.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added and an accuracy column is inserted in the monthly-discharge table. The accuracy column does not apply to the maximum or minimum, nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent.; B, within 10 per cent.; C, within 15 per cent.; D, within 25 per cent. Special conditions are covered by footnotes.

#### HUDSON RIVER DRAINAGE BASIN.

##### *Description.*

The principal sources of Hudson river lie in the wildest portion of the Adirondack mountains, in Essex county, northeastern New York. A number of branches, any one of which might possibly be considered the main stream, form its upper waters; but if the highest collected and permanent body of water be assumed as the true head, then the source of the Hudson becomes Lake Tear-of-the-Clouds, which lies at an elevation of 4,322 feet above tide, in the center of the triangle formed by Mount Marcy and Skylight and Gray Peaks.

The river flows rather irregularly southward until it reaches the northern boundary of Saratoga county, where it makes a sharp turn and flows eastward for about 12 miles, passing through the mountains and forming, as it cuts across the rocky strata, several falls of great height and beauty. At Hudson Falls, just below Glens Falls, it makes another abrupt turn and flows southward, continuing in this direction until it empties into New York bay.

From Lake Tear-of-the-Clouds to the mouth of the river the distance by water is probably about 300 miles. The total area drained is 13,366 square miles. The river is tidal to Troy, which is also at the head of navigation.

The headwater region is mountainous in character, is in general heavily wooded, and is dotted with numerous lakes and ponds. The rocks, belonging to the oldest formation and mainly granitic, are either bare or covered only with a layer of spruce duff, humus, and forest litter. The river emerges from the mountain region a few miles west of Glens Falls, and thence to Troy the topography is moderately rolling and the surface soil is chiefly sand. Below Troy the river follows the great depression which extends almost due north and south between New York bay and the St. Lawrence, flowing in an open valley bordered by well-cultivated lands, which rise with moderate slope from the stream. The Catskill Mountain region is reached 20 or 30 miles below Albany, and thence to the mouth of the river the immediate valley is flanked by high hills, the Highlands of Orange county and the precipitous Palisades being especially noticeable.

The fall in the upper portion of the course is very rapid, amounting to about 64 feet per mile from Lake Tear-of-the-Clouds to the mouth of North creek, a distance of about 52 miles. From the mouth of North creek to the mouth of the Sacandaga the descent is nearly 14 feet per mile, distributed

among rapids which diminish in frequency as the Sacandaga is approached. In the succeeding 26 miles to Fort Edward the river descends 418 feet more, but of this 175 feet is comprised within the three abrupt pitches at Palmer, Glens, and Bakers Falls, while most of the remainder occurs in the rapids between Jessup's Landing and the oxbow above Glens Falls. Between Glens Falls and Troy nearly the entire fall of the river is utilized for the development of water power.

The tributaries of the Hudson are numerous, and many of them are large and important. Indian river, Schroon river, and the Sacandaga unite with the main stream above Glens Falls, and between the latter point and Troy it receives Batten Kill, Fish creek, Hoosic river, and the Mohawk, the latter having several important tributaries, including West and East Canada and Schoharie creeks. The tributaries below Troy include Catskill, Esopus, and Rondout creeks, and Wallkill river from the west, and Kinderhook creek, Jansen Kill, Wappinger creek, Fishkill creek, and Croton river from the east.

The mean annual precipitation on the total basin of the Hudson is probably about 43 inches. It reaches a maximum of more than 55 inches in the heights of the Adirondacks, while in the eastern portion of the drainage area in southern Vermont, the mean annual total is only about 39 inches. Conditions during the winter period vary from the extreme cold and deep snow of the Adirondacks to the areas in the southern portion of the basin which are subject to frequent winter thaws.

The flow of the Upper Hudson is controlled to some extent during the dry season by the use of Indian Lake storage reservoir, and the natural storage facilities in the Adirondack region are unsurpassed, there being a great many ponds and lakes, many of large size and fed from extensive drainage areas. Comprehensive plans for vast storage projects on the Sacandaga, Schroon, and Upper Hudson are receiving the attention of the State of New York Conservation Commission. It is probable that on the various tributaries of the Hudson an increase in storage capacity of some 75 billion cubic feet is possible, and if this were developed the Hudson would be probably the most important water-power stream in the country. While a large amount of power has been developed in the Hudson drainage area there are vast quantities as yet unutilized, and the importance of this river basin is apparent, when it is considered that in proportion to its size it contains a greater population than any other important drainage basin in the United States with the single exception of that of the Delaware river.

The longest run-off record in the Hudson river drainage basin is that obtained at Mechanicville, which extends back to 1888.

#### *Hudson River at North Creek, N. Y.*

*Location.*—At the highway bridge in the village of North Creek, immediately above the mouth of North Creek, which enters the Hudson from the right.

*Records available.*—September 21, 1907, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—804 square miles.

*Gage.*—Chain, read twice daily; datum unchanged since established.

*Channel.*—Heavy gravel; considered fairly permanent.

*Discharge measurements.*—Made from the two-span steel highway bridge.

*Artificial control.*—The numerous lakes and ponds in the basin of the upper Hudson have a decided effect on the low water flow, especially is this true of Indian lake.<sup>1</sup> The use of these storage reservoirs in the spring in connection with log-driving tends to vitiate the daily records at all the gaging stations. Where possible, allowance is made for the effect of logging operations.

*Winter flow.*—Winters are severe in the northern part of the State and determinations of flow for the winter months are approximate because of ice.

*Accuracy.*—Discharge rating curve very well defined. Determinations of discharge for open water periods considered excellent.

*Co-operation.*—Station established and maintained by United States Geological Survey in co-operation with the State of New York Conservation Commission.

<sup>1</sup>See Indian Lake at Indian Lake, N. Y.

*Discharge Measurements of Hudson River at North Creek, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of Section.	Gage Height.	Discharge.
		<i>Feet.</i>	<i>Sq. Ft.</i>	<i>Feet.</i>	<i>Sec. Ft.</i>
Jan. 19 a. ....	F. J. Shuttleworth. ....	203	635	4.46	728
Feb. 11 b. ....	C. C. Covert. ....	213	547	4.40	709
Feb. 28 c. ....	F. J. Shuttleworth. ....	210	431	4.00	661
Apr. 7 d. ....	C. S. De Golyer. ....	248	588	4.26	1,700
Apr. 19. ....	W. G. Hoyt. ....	248	992	4.85	3,770
June 9. ....	C. S. De Golyer. ....	248	693	3.37	1,360
July 13. ....	G. H. Canfield. ....	249	614	3.67	1,010
July 16. ....	G. H. Canfield. ....	248	623	3.12	1,020
Nov. 18 e. ....	F. Weber. ....	248	610	3.04	902

a Partial ice cover; average thickness of ice 1.2 feet.

b Partial ice cover; average thickness of ice 1.4 feet.

c Complete ice cover; average thickness of ice 1.3 feet.

d 95 per cent. ice cover; average thickness of ice 1.4 feet.

e Some floating ice and shore ice.

CONSERVATION COMMISSION.

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Daily gage height, in feet, of Hudson River at North Creek, N.Y., for 1911.

[Gilbert Dean, observer.]

DAY.	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.3			4.2	6.8	2.65	2.39	3.0	2.65	2.7	2.8	3.1
2.....	3.4				7.8	3.2	2.38	2.97	2.15	2.75	2.9	3.1
3.....	3.3				7.6	3.15	2.25	2.96	2.02	2.8	2.8	3.0
4.....	3.03		3.5		6.1	3.1	2.18	2.94	1.98	2.95	2.75	2.85
5.....	3.05	4.2			5.2	3.0	2.11	2.94	1.98	3.2	2.7	2.7
6.....	3.35				3.8	3.2	2.06	2.94	2.28	3.4	2.7	2.8
7.....	3.4				4.6	3.2	2.7	2.94	2.7	3.3	2.75	2.7
8.....	3.7				4.4	3.75	3.3	2.8	2.94	3.0	3.3	2.7
9.....	3.75				4.3	3.95	3.4	2.8	2.92	3.1	3.2	2.69
10.....					4.2	4.6	3.6	2.9	2.9	2.8	3.05	2.8
11.....		4.4	3.9		4.2	3.9	3.6	3.1	2.91	2.6	3.0	3.65
12.....					4.2	4.3	4.0	3.1	2.9	2.65	2.8	3.45
13.....					4.3	4.2	4.2	3.05	2.89	2.46	2.7	3.55
14.....	3.5				3.3	4.4	4.4	3.05	2.88	2.44	2.6	3.65
15.....					3.35	4.2	4.2	3.05	2.87	2.41	2.5	3.6
16.....					5.6	2.38	4.3	3.1	2.86	2.55	2.48	3.3
17.....					5.3	2.85	3.8	3.05	2.87	2.6	2.43	3.1
18.....		4.2	3.8		4.9	4.4	3.6	2.95	2.86	2.7	2.55	3.05
19.....					4.9	3.1	3.3	2.8	2.86	2.7	3.1	3.15
20.....					4.9	2.65	3.05	2.75	2.86	2.40	3.4	3.15
21.....	4.2				5.2	3.45	2.9	2.75	2.84	2.30	3.35	3.06
22.....					4.8	2.38	2.8	2.7	2.82	2.75	3.3	3.0
23.....					4.7	3.4	2.7	2.7	2.8	2.75	3.25	3.0
24.....					4.8	2.8	2.6	2.7	2.78	2.7	3.5	2.9
25.....		4.0	3.6		5.3	3.4	2.5	2.7	2.78	2.75	3.55	2.75
26.....					6.0	2.4	2.46	2.8	2.8	2.7	3.3	2.7
27.....	3.7				6.5	3.7	2.44	3.0	2.78	2.7	3.15	2.7
28.....					6.6	3.5	2.7	3.0	2.8	2.65	3.0	2.6
29.....					6.7	2.9	2.8	3.05	2.98	2.65	2.9	2.75
30.....					6.3	2.8	2.42	3.0	3.3	2.65	2.85	3.1
31.....						2.6		3.0	2.92		2.75	3.15

NOTE.—Relation of gage height to discharge affected by ice from January 1 to April 7. Probably no backwater during December. Gage heights were probably to the surface of the water. No notes regarding backwater from logs given by the observer.

Daily discharge, in second-feet, Hudson River at North Creek, N. Y., for 1910.

DAY.	Jan.	Feb.	Mar.	April	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....				9,790	2,080	3,385	474	810	940	840	1,550	790
2.....				9,640	2,600	2,920	454	754	1,120	682	1,480	780
3.....				7,080	3,140	2,210	430	772	1,040	602	1,480	840
4.....				5,200	4,630	1,890	412	1,010	1,100	562	1,450	810
5.....				4,860	4,260	1,800	382	1,350	1,160	562	1,080	745
6.....				4,850	3,250	2,240	364	1,101	1,310	554	1,420	700
7.....				5,120	3,331	3,230	340	940	1,550	1,280	1,420	682
8.....				5,730	3,140	3,660	340	718	1,650	1,200	1,160	
9.....				3,580	4,260	3,420	325	610	1,480	1,100	990	
10.....				2,570	2,710	2,870	310	701	1,380	1,150	890	
11.....				3,330	3,010	2,480	295	1,320	1,160	1,200	840	
12.....				3,580	1,770	2,550	594	2,240	990	1,120	870	
13.....				2,710	1,350	2,350	594	1,590	930	1,120	790	
14.....				2,260	1,560	2,000	570	1,250	910	1,100	736	
15.....				890	1,280	1,800	530	890	870	1,010	691	
16.....				2,050	1,041	1,580	562	1,220	790	940	655	
17.....				628	910	1,430	562	1,100	736	910	610	
18.....				1,450	810	1,680	562	1,100	700	910	530	
19.....				2,000	890	1,840	530	1,040	682	1,080	488	
20.....				6,380	910	1,550	530	970	664	1,100	400	
21.....				3,140	1,170	1,450	530	840	664	1,080	330	
22.....				1,740	1,250	1,220	538	840	700	1,120	810	
23.....				2,540	2,710	1,420	990	530	840	673	1,160	840
24.....				2,540	1,320	1,280	870	530	790	655	1,220	840
25.....				5,200	1,740	1,740	772	530	736	646	1,200	840
26.....				7,220	1,120	3,760	682	523	709	691	1,280	830
27.....				6,180	3,880	5,080	655	502	700	735	1,620	870
28.....				5,320	1,480	3,440	610	546	700	1,300	1,770	810
29.....				6,740	1,080	2,660	546	790	691	1,350	1,920	790
30.....				8,650	5,020	2,320	495	745	664	1,040	1,800	800
31.....				9,430		2,710		810	655		1,770	

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Note that the daily discharge for the winter months for the periods January 22 to 29, March 1 to 22, December 8 to 31, also the period November 22 to December 7, as published in the Sixth Annual Report of the New York State Water Supply Commission, and the 1910 report of the State Engineer and Surveyor, State of New York, has been revised. The daily discharge for January 1 to March 22 and December 8 to 31, has not been published in the Federal report because it is only approximate.



## FIRST ANNUAL REPORT OF THE

Daily discharge, in second-feet, of Hudson River at North Creek, N. Y., for 1911.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		8,620	570	394	890	570	610	700	990
2.		11,600	1,100	388	860	268	655	790	990
3.		11,000	1,040	315	850	213	700	700	890
4.		6,690	990	281	830	198	840	655	745
5.		4,520	890	250	830	188	1,100	610	610
6.		1,920	1,100	229	830	330	1,350	610	700
7.	1,700	3,290	1,100	610	830	610	1,220	655	610
8.	1,900	1,840	1,220	700	830	890	1,220	1,220	610
9.	2,100	2,160	1,350	700	810	990	1,100	1,620	602
10.	2,300	3,100	1,620	790	790	700	940	1,840	700
11.	2,500	2,080	1,620	990	800	530	890	1,700	1,040
12.	2,570	2,740	2,240	990	790	570	700	1,420	1,700
13.	2,740	2,570	2,570	940	781	436	610	1,550	4,300
14.	3,000	1,220	2,920	940	772	424	530	1,700	5,930
15.	4,000	1,280	2,570	940	763	406	460	1,620	4,970
16.	5,200	388	2,740	990	754	495	448	1,220	3,680
17.	4,740	745	1,920	940	763	530	418	990	3,100
18.	3,880	2,920	1,620	840	754	610	495	940	2,400
19.	3,880	990	1,220	700	745	448	990	1,040	1,840
20.	3,880	570	940	655	745	400	1,350	1,040	1,480
21.	4,520	1,420	790	655	736	340	1,280	940	1,220
22.	3,680	388	700	610	718	655	1,220	890	1,160
23.	3,480	1,350	610	610	700	655	1,160	890	2,000
24.	3,680	700	530	610	682	610	1,480	790	2,920
25.	4,740	1,350	460	610	682	655	1,550	655	2,740
26.	6,430	401	436	700	700	610	1,220	610	2,400
27.	7,770	1,770	424	890	682	610	1,040	610	2,080
28.	8,050	1,480	610	890	700	570	890	530	1,700
29.	8,330	790	700	940	870	570	790	655	1,100
30.	7,220	700	412	890	1,220	570	745	990	1,040
31.		530		890	810		655		1,040

NOTE.— Daily discharge determined from a well-defined discharge rating curve.

Monthly discharge of Hudson River at North Creek, N. Y., for 1910.

[Drainage area, 804 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Accu- racy.
January.....			593	.738	.85	C
February.....			677	.842	.88	C
March.....	9,430		3,640	4.53	5.22	C
April.....	9,790	828	3,560	4.43	4.94	A
May.....	5,080	810	2,380	2.96	3.41	A
June.....	3,660	495	1,840	2.29	2.56	A
July.....	810	295	508	.632	.73	A
August.....	2,240	610	956	1.19	1.37	A
September.....	1,650	646	986	1.23	1.37	A
October.....	1,920	554	1,130	1.41	1.63	A
November.....	1,550	330	910	1.13	1.26	A
December.....			570	.709	.82	C
The year.....	9,790	295	1,480	1.84	25.04	

NOTE.— Discharge January 1 to March 22 and December 8 to 31 estimated by means of two measurements made with ice present, climatological records, consideration of storage and comparison of the discharge with that at other stations.

Mean discharge January 1 to 21, estimated 361 second-feet; practically constant.

Mean discharge January 22 to 31, estimated 1090 second-feet, ranging from 1,800 to 700 second-feet.

Daily discharge during February practically constant.

Mean discharge March 1 to 22, estimated 2690 second-feet, ranging from 6,000 to 1,200 second-feet.

Mean discharge December 8 to 31, estimated 514 second-feet.

Daily discharge December 8 to 31 nearly constant.

The discharge for February was increased over 100 second-feet by draft on Indian Lake storage. Similarly discharge November 22 to 30 was increased over 300 second-feet and that for December was increased 240 second-feet.

Comparisons with Schroon River and Hudson River at Thurman indicate that the monthly discharge for May may be too high.

Determinations of discharge for January, March, November, and December have been revised, and supersede those published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.

*Monthly discharge of Hudson River at North Creek, N. Y., for 1911.*  
 [Drainage area, 804 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Accuracy.
January.....	.....	.....	750	.933	1.08	C
February.....	.....	.....	685	.852	.89	C
March.....	.....	.....	675	.840	.97	C
April.....	8,330	.....	3,570	4.44	4.95	A
May.....	11,600	388	2,620	3.26	3.76	A
June.....	2,920	412	1,230	1.53	1.71	A
July.....	990	229	706	.878	1.01	A
August.....	1,220	682	791	.984	1.13	A
September.....	990	188	522	1.650	.72	B
October.....	1,550	418	924	1.15	1.33	A
November.....	1,840	530	1,010	1.26	1.41	A
December.....	5,930	602	1,850	2.30	2.65	A
The year.....	11,600	188	1,280	1.59	21.61	

NOTE.—Discharge January 1 to April 7, estimated by means of 4 discharge measurements made with ice present, the discharge at other stations in the upper Hudson River basin, and climatological records. In determining discharge for February, due allowance was made for effect of draft on storage at Indian Lake, amounting to about 170 second-feet. No material effect from storage during January and March.

Mean discharge April 1 to 6, estimated 817 second-feet.

#### *Hudson River at Thurman, N. Y.*

**Location.**—At the Delaware and Hudson Railroad bridge leading from Thurman to Warrensburg, about 950 feet below the highway bridge to Warrensburg, about 2,000 feet below the mouth of Schroon river, and about 13 miles above the mouth of Sacandaga river, which enters from the right.

**Records available.**—September 1, 1907, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

**Drainage area.**—1,550 square miles.

**Gage.**—Chain; read three times daily; datum unchanged.

**Channel.**—Sand and gravel, liable to shift.

**Discharge measurements.**—Made from the bridge.

**Artificial control.**—The influence of storage at Indian Lake and of mill control on Schroon river is observable at this station.

**Winter flow.**—Station discontinued during the winter months because of ice. Winter flow estimated from the determinations of combined flow at Riverbank and North Creek plus an estimated inflow between the two stations.

**Accuracy.**—Accuracy of the determinations to some extent impaired as the result of accumulations of logs at the control point below the section and also around the piers of the bridge. Discharge rating curve very well defined and determinations of flow during the open water season are considered fairly accurate.

**Co-operation.**—Station established by the United States Geological Survey in co-operation with the State of New York Conservation Commission. Gage

heights January to March and December 16th to 31st, furnished by Albany office of United States Weather Bureau.

*Discharge measurements of Hudson River at Thurman, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
June 7 a...	G. H. Canfield.....	270	890	3.27	1,880
July 28 a...	G. H. Canfield.....	265	778	2.88	984
July 28 a...	G. H. Canfield.....	265	780	2.88	979
Sept. 2 a...	G. H. Canfield.....	244	634	2.31	519
Sept. 2 a...	Frank Weber.....	244	615	2.22	474
Sept. 27 a...	G. H. Canfield.....	255	688	2.56	689
Nov. 13 a...	Frank Weber.....	273	954	3.58	2,140

a Log jams in river below bridge produced backwater effect at gage.

*Daily gage height, in feet, of Hudson River at Thurman, N. Y., for 1911.*

[S. H. Spencer, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.8	4.1	4.4	.....	6.40	2.85	2.55	2.88	2.75	2.90	3.65	5.30
2.....	4.2	4.2	4.4	.....	7.10	3.00	2.19	2.94	2.25	2.75	3.10	3.25
3.....	4.3	4.5	4.4	.....	6.90	2.85	2.26	2.82	1.95	2.70	2.90	3.20
4.....	4.2	4.4	4.3	.....	6.00	2.85	1.95	2.80	1.90	2.90	2.72	2.95
5.....	3.9	4.5	4.2	.....	5.70	2.85	2.37	2.85	2.00	3.10	2.95	3.00
6.....	3.8	4.5	4.4	.....	4.70	2.95	2.70	2.75	2.08	3.25	2.95	3.05
7.....	3.9	4.5	4.4	.....	5.20	3.25	2.75	2.77	3.05	3.25	3.05	2.95
8.....	3.8	4.5	4.3	.....	3.80	3.35	3.05	2.81	2.75	3.15	3.30	2.77
9.....	4.1	4.5	4.3	.....	4.50	3.45	2.80	2.75	3.25	3.25	3.65	2.90
10.....	4.0	4.5	4.3	.....	4.40	3.25	2.95	2.77	2.85	3.10	3.75	3.00
11.....	4.0	4.6	4.3	.....	4.40	3.30	3.10	2.77	2.85	2.95	3.70	3.20
12.....	4.0	4.5	3.9	.....	3.80	3.75	3.05	2.75	2.75	2.80	3.40	3.55
13.....	4.0	4.4	4.2	.....	3.60	3.95	2.95	2.74	2.60	2.55	3.40	4.50
14.....	4.0	4.6	4.0	.....	3.85	4.20	2.95	2.77	2.48	2.70	3.70	5.20
15.....	4.0	4.5	4.0	.....	3.55	3.95	3.00	2.76	2.43	2.27	3.65	5.00
16.....	4.0	4.5	4.0	.....	3.05	4.20	2.85	2.74	2.38	2.60	3.55	4.50
17.....	3.8	4.5	3.8	.....	3.00	3.75	3.10	2.72	2.45	2.41	3.25	4.30
18.....	3.8	4.3	3.9	.....	4.10	3.50	3.00	2.75	2.90	Est.	3.35	4.10
19.....	4.0	4.4	3.8	.....	3.25	3.30	2.95	2.77	2.60	3.55	3.40	3.80
20.....	4.3	4.4	3.7	.....	2.95	3.15	2.75	2.62	2.41	3.55	3.45	3.60
21.....	4.3	4.7	3.6	.....	3.70	3.05	2.75	2.74	2.23	3.55	3.40	3.40
22.....	4.3	4.5	3.7	.....	3.30	3.00	2.65	2.67	2.65	3.35	3.25	3.40
23.....	4.3	4.4	3.7	.....	2.90	2.25	2.50	2.67	2.65	3.40	3.30	4.40
24.....	4.3	4.9	3.7	.....	3.20	2.15	2.70	2.63	2.60	3.55	3.20	4.50
25.....	4.3	4.5	3.7	.....	3.50	2.50	2.55	2.67	2.60	3.60	3.00	4.40
26.....	4.3	4.4	3.6	.....	3.70	2.65	2.60	2.66	2.60	3.45	2.90	4.50
27.....	4.2	4.5	4.0	.....	3.05	2.65	2.90	2.60	2.55	3.30	3.00	4.10
28.....	4.3	4.4	4.3	.....	3.15	2.65	2.90	2.75	2.50	3.20	2.95	4.00
29.....	4.2	.....	4.3	.....	2.95	2.95	2.95	2.91	2.55	3.05	3.10	3.50
30.....	4.0	.....	4.3	.....	2.74	2.65	2.75	2.97	2.60	3.10	3.35	3.50
31.....	4.1	.....	4.3	.....	2.75	.....	2.85	2.85	.....	3.05	.....	3.50

NOTE.—Relation of gage height to discharge affected by ice from January to March and probably during the first few days in April. There was no backwater from ice during December. It is not known whether readings during January to March were to water surface or to the top of the ice. Gage heights January 1 to March 31 and December 17 to 31 were taken from the records of the U. S. Weather Bureau. During practically all the period from May to December backwater, caused by log jams below the gage, existed at this station. There may, however, have been no backwater during the first part of May and during December.

CONSERVATION COMMISSION.

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Daily discharge, in second-feet, of Hudson River at Thurman, N. Y., for 1910.

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		15,400	4,070	6,220	1,260	1,000	1,160	1,380	2,110	1,300
2.		15,900	5,830	5,740	864	1,080	1,490	1,130	2,010	1,140
3.		12,500	3,280	4,860	720	829	1,510	1,200	2,030	1,140
4.		10,600	5,000	4,290	700	1,380	1,450	1,060	2,050	1,000
5.		10,400	4,660	3,850	1,130	1,720	1,600	1,070	2,200	1,000
6.		8,350	5,470	4,980	988	1,450	1,660	1,950	2,380	1,140
7.		9,380	4,690	6,190	950	1,140	1,940	1,660	2,290	1,140
8.		10,100	5,440	6,310	900	1,030	2,380	1,580	2,090	
9.		7,480	4,720	6,040	730	852	1,920	1,550	2,890	
10.		6,100	5,060	5,920	643	740	1,820	1,680	1,700	
11.		4,770	4,980	5,060	710	1,060	1,530	1,640	1,510	
12.		5,770	3,690	5,090	690	2,470	1,470	1,490	1,420	
13.		4,890	3,160	4,770	962	2,050	1,330	1,560	1,230	
14.		3,330	3,160	4,210	864	3,360	1,220	1,600	1,220	
15.		3,710	3,090	3,770	829	1,230	1,060	1,470	1,300	
16.		4,260	2,470	3,300	710	1,400	962	1,260	1,260	
17.		2,800	2,220	3,300	643	1,440	988	1,300	1,080	
18.		2,570	2,310	3,280	875	1,420	1,000	1,330	912	
19.		5,060	1,940	4,350	875	1,400	1,110	1,490	888	
20.		10,500	1,820	3,180	852	1,130	950	1,560	852	
21.		5,950	2,380	2,940	829	980	950	1,550	772	
22.		5,180	2,220	2,640	806	829	1,030	1,400	888	
23.	4,570	6,220	2,450	2,290	772	975	938	1,470	1,260	
24.	5,740	5,210	2,520	1,920	600	975	962	1,700	1,250	
25.	7,610	5,040	3,280	1,780	772	975	1,070	1,740	1,200	
26.	11,200	4,870	6,040	1,620	730	900	1,160	1,680	1,160	
27.	10,100	4,710	6,010	1,560	660	829	1,230	2,220	1,170	
28.	10,200	4,550	5,470	1,550	643	652	2,430	2,360	1,110	
29.	11,700	4,390	4,690	1,510	900	900	2,270	2,430	1,200	
30.	13,800	4,230	4,740	1,420	794	875	1,960	2,380	1,280	
31.	15,200		5,740		1,000	840		2,380		

NOTE.— Daily discharge determined from a well defined discharge rating curve.

Discharge interpolated April 25 to 30 and August 21.

The discharge for March 23 to 26, and December 1 to 7, has been ascertained and added to the values published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.

Daily discharge, in second-feet, of Hudson River at Thurman, N. Y., for 1911.

DAY.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	11,100	1,380	788	978	845	1,000	1,190	6,780
2.	13,200	1,660	509	1,050	485	845	1,260	1,500
3.	12,600	1,380	554	912	358	800	1,000	1,410
4.	9,920	1,380	375	890	340	1,000	818	1,060
5.	9,020	1,380	632	945	375	1,260	1,060	1,120
6.	6,020	1,560	945	845	407	1,500	1,060	1,190
7.	7,520	1,840	1,010	863	1,190	1,500	1,190	1,060
8.	3,480	2,040	1,460	901	845	1,340	1,580	863
9.	5,440	2,260	1,070	845	1,500	1,500	2,300	1,000
10.	5,150	1,840	1,060	863	945	1,260	2,510	1,120
11.	5,150	1,940	1,260	863	945	1,060	2,400	1,410
12.	3,480	2,960	1,190	845	845	890	1,770	2,080
13.	2,990	3,460	1,060	836	715	678	1,770	4,430
14.	3,610	4,140	1,060	863	626	800	2,400	6,480
15.	2,870	3,460	1,120	854	591	495	2,300	5,880
16.	1,760	4,140	945	836	558	715	2,080	4,430
17.	1,660	2,960	1,260	818	605	577	1,500	3,870
18.	4,290	2,370	1,120	845	1,000	600	1,680	3,340
19.	2,180	1,940	1,060	863	715	2,080	1,770	2,620
20.	1,560	1,640	845	732	577	2,080	1,880	2,190
21.	3,230	1,460	845	836	475	2,080	1,770	1,770
22.	2,290	1,380	758	775	758	1,680	1,500	1,770
23.	1,470	1,140	640	775	758	1,770	1,580	4,150
24.	2,070	1,010	800	740	715	2,080	1,410	4,430
25.	2,750	740	678	775	715	2,190	1,120	4,150
26.	3,230	890	715	766	715	1,880	1,000	4,430
27.	1,760	890	1,000	715	678	1,580	1,120	3,340
28.	1,960	890	1,000	845	640	1,410	1,060	3,090
29.	1,560	1,300	1,060	1,010	678	1,190	1,260	1,980
30.	1,200	890	845	1,080	715	1,260	1,680	1,980
31.	1,220		945	945		1,190		1,980

NOTE.— Daily discharge determined from three discharge rating curves applied as follows:

Curve 1, the 1910 curve, applied May 1 to June 6; curve 2, constructed from measurements made June 7, applied June 7 to July 9; curve 3, constructed from six discharge measurements made July to November, applied July 10 to December 31.

## FIRST ANNUAL REPORT OF THE

Monthly discharge of Hudson River at Thurman, N. Y., for 1910.  
[Drainage area, 1,550 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Accuracy.
January.....	.....	.....	900	.581	.67	C
February.....	.....	.....	1,200	.774	.81	C
March.....	15,200	.....	6,500	4.19	4.83	C
April.....	15,900	2,570	6,810	4.39	4.90	A
May.....	6,040	1,820	3,950	2.55	2.94	A
June.....	6,310	1,420	3,800	2.45	2.73	A
July.....	1,260	600	819	.528	.61	A
August.....	3,360	652	1,220	.787	.91	A
September.....	2,430	938	1,420	.916	1.02	A
October.....	2,430	950	1,590	1.03	1.19	A
November.....	2,890	772	1,490	.961	1.07	A
December.....	.....	.....	860	.555	.64	C
The year.....	15,900	600	2,550	1.65	22.32	

NOTE.—Discharge for January, February, March, and December estimated from the combined flow at North Creek and Riverbank, plus an estimated inflow between Thurman and North Creek and Riverbank, due consideration being given to the effect of storage regulation at Indian Lake reservoir.

Discharge for January, February and March revised, superseding that published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.

Discharge January 1–22, February 1–28, and December 8–31 relatively constant.

Mean discharge January 1–21 about 570 second-feet.

Mean discharge January 22–31 about 1,600 second-feet, ranging approximately from 1,200 to 2,300 second-feet.

Mean discharge March 1–22 about 5,070 second-feet, ranging approximately from 7,500 to 2,500 second-feet.

Mean discharge December 8–31 about 784 second-feet.

Monthly discharge of Hudson River at Thurman, N. Y., for 1911.  
Drainage area, 1,550 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Accuracy.
January.....	.....	.....	1,200	.774	.89	C
February.....	.....	.....	1,000	.645	.67	C
March.....	.....	.....	1,250	.806	.93	C
April.....	.....	.....	7,000	4.52	5.04	C
May.....	13,200	1,200	4,380	2.83	3.26	B
June.....	4,140	740	1,880	1.21	1.35	C
July.....	1,460	375	923	.595	.69	C
August.....	1,080	715	862	.556	.64	C
September.....	1,500	340	710	.458	.51	B
October.....	2,190	495	1,300	.839	.97	B
November.....	2,510	818	1,570	1.01	1.13	C
December.....	6,780	863	2,800	1.81	2.09	C
The year.....	13,200	340	2,070	1.34	18.17	

NOTE.—Monthly discharge January to April estimated from the combined flow at North Creek and Riverbank, plus an estimated inflow between Thurman and North Creek and Riverbank, effect of storage regulation at Indian Lake reservoir being given due consideration.

## Hudson River at Mechanicville, N. Y.

Location.—At the Duncan dam of the West Virginia Pulp and Paper Company in the village of Mechanicville about 3,700 feet above the mouth of Anthony Kill (coming in from the right),  $1\frac{1}{4}$  miles below the mouth of

Hoosic river (coming in from the left) and 19 miles above the mouth of Mohawk river which enters from the right at Cohoes.

*Records available.*—1888 to 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—4,500 square miles.

*Gage.*—Recording gage installed at the dam in the summer of 1910 for the purpose of obtaining a more accurate register of the daily flow over the crest of the dam; previous to 1910 two gage readings daily on the crest of the dam.

*Discharge measurements.*—Determinations of discharge for periods previous to the summer of 1910 computed by using two daily gage readings on the crest of the dam and continuous record of the run of the wheels in the adjoining paper mill. In 1904 the dam was raised and a concrete crest and apron were added, so that it now has a rounded or ogee section. A discharge curve has been calculated by means of co-efficients derived from the United States Geological Survey experiments on dams of ogee section.

*Accuracy.*—Records at this station are very carefully made and may be considered good for this type of station.

*Co-operation.*—Records are computed and furnished by Mr. R. P. Bloss, engineer of the West Virginia Pulp and Paper Company.

The records which have been kept at this station since 1888 are among the longest in the State. They have been used as basic data in all studies of storage problems on the upper Hudson. In using these records it should be remembered that water is diverted past this station in the Champlain Canal.

*Daily discharge of Hudson River at Mechanicville, N. Y., for 1911.*

DAY.	Jan.	Feb.	Mar.	April.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	a2,989	3,648	4,711	10,097	23,150	3,313	1,798	2,038	2,687	a489	6,386	8,867
2.....	4,340	2,761	3,794	a8,047	22,894	2,969	a2,389	1,770	1,251	1,991	6,172	7,539
3.....	13,137	4,522	3,922	8,720	26,241	3,507	2,359	1,368	a1,439	3,230	5,908	a5,756
4.....	14,021	2,474	3,761	7,481	24,834	a2,436	1,972	1,472	2,208	3,034	5,629	7,459
5.....	9,415	a4,302	a1,695	7,061	20,943	4,113	1,493	1,317	1,027	3,823	a3,917	4,985
6.....	7,554	3,279	2,158	13,543	15,808	3,478	1,492	a391	1,746	4,838	6,644	4,633
7.....	6,587	4,123	3,737	16,775	a11,293	3,072	1,650	994	1,446	4,906	5,029	4,344
8.....	a5,571	3,276	2,796	19,541	14,434	4,349	1,284	1,706	1,688	a4,305	6,503	4,434
9.....	7,394	3,291	1,882	a16,937	9,258	5,229	a670	1,444	2,035	5,566	7,448	5,055
10.....	5,920	3,401	2,592	17,207	9,643	5,654	924	1,143	a3,080	5,283	8,447	a3,495
11.....	5,461	3,870	3,110	17,119	7,632	a3,274	1,154	1,088	6,507	4,797	7,864	5,896
12.....	5,125	a3,356	a1,633	16,027	7,916	5,498	1,393	1,337	4,148	4,488	a5,759	5,924
13.....	4,292	2,763	1,892	15,877	7,186	5,241	1,548	a368	3,626	4,045	12,149	7,420
14.....	3,894	2,785	4,142	16,812	a4,898	6,822	1,133	1,070	3,772	4,367	9,506	11,575
15.....	a3,759	2,779	4,051	22,033	7,821	9,402	1,587	1,581	3,641	a1,854	9,642	14,133
16.....	5,318	2,683	8,500	a23,628	5,279	9,007	a600	1,137	3,163	2,988	7,769	13,273
17.....	3,414	2,203	5,162	24,638	5,469	8,946	1,460	1,709	a718	2,984	7,370	a13,709
18.....	2,960	2,903	4,279	22,892	4,589	a6,026	1,983	1,167	1,179	6,176	6,643	14,978
19.....	3,442	a3,217	a3,002	20,404	4,768	8,506	1,426	1,230	2,310	16,047	a10,961	12,718
20.....	2,302	3,338	5,456	18,774	5,760	5,203	1,354	a995	1,105	16,528	11,761	11,006
21.....	1,894	4,140	5,183	18,332	a3,346	4,670	1,425	1,004	1,025	13,781	10,086	8,941
22.....	a3,253	3,292	4,636	17,671	5,512	3,780	1,402	865	1,590	a14,123	9,053	8,096
23.....	1,963	3,579	7,926	a15,246	5,097	3,483	a1,282	1,046	943	16,171	7,977	13,181
24.....	3,846	2,873	7,255	16,890	3,380	2,379	1,185	1,040	a718	14,143	7,141	a18,220
25.....	3,383	1,974	5,835	15,574	4,831	a1,745	1,182	1,140	1,165	13,045	7,730	18,623
26.....	2,243	a2,257	a4,412	15,431	3,989	2,057	1,368	1,178	1,123	11,244	a5,175	17,475
27.....	3,150	6,035	12,921	17,420	4,554	3,042	967	a333	1,050	10,111	7,664	15,878
28.....	8,504	5,125	19,893	19,291	a2,835	2,920	1,148	629	1,004	8,612	5,797	15,184
29.....	a6,338	.....	13,788	22,014	6,180	1,644	1,205	888	1,030	a5,770	6,469	11,593
30.....	6,912	.....	13,446	a21,554	3,851	1,025	a369	1,550	1,680	8,761	8,283	8,686
31.....	5,013	.....	11,457	.....	3,747	.....	1,048	1,577	.....	6,786	.....	a8,615

a Sunday.

*Monthly discharge of Hudson River at Mechanicville, N. Y., for 1911.*  
 [Drainage area 4,500 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.
January.....	14,000	1,890	5,270	1.17	1.35
February.....	6,040	1,970	3,370	.749	.78
March.....	19,900	1,630	5,780	1.28	1.48
April.....	24,600	7,060	16,800	3.73	4.16
May.....	26,200	2,840	9,260	2.06	2.88
June.....	9,400	1,020	4,430	.985	1.10
July.....	2,390	369	1,360	.302	.35
August.....	2,040	368	1,180	.262	.30
September.....	6,510	718	2,000	.444	.50
October.....	16,500	489	7,240	1.61	1.86
November.....	12,100	3,920	7,560	1.68	1.87
December.....	18,600	3,500	10,000	2.22	2.54
The year.....	26,200	368	6,030	1.34	18.67

NOTE.— Computations by engineers of United States Geological Survey.

*Cedar River near Indian Lake, N. Y.*

*Location.*— At the steel highway bridge about 2 miles west of Indian Lake village, on the road leading to Blue Mountain lake, about 12 miles by river above its confluence with the Hudson, 8 miles by river above the mouth of Rock river (tributary from the left) and 10 miles by river below Cedar River Flow (Wakely dam).

*Records available.*— July 15, 1911, to December 31, 1911. Published also in annual report of the United States Geological Survey.

*Drainage area.*— 95 square miles.\*

*Gage.*— Standard chain and weight.

*Channel.*— Coarse gravel and small boulders, fairly permanent. Low water control is gravel rift about 200 feet below the bridge.

*Storage.*— The basin contains many lakes and swamps affording favorable sites for storage reservoirs which would be influential in regulating the discharge of the Hudson river. The important lakes above the site are the Cedar lakes and Cedar River Flow. Cedar River Flow is controlled by a lumberman's dam and is used principally during the logging season.

*Accuracy.*— Discharge rating curve not yet determined.

*Co-operation.*— Established and maintained in co-operation with the United States Geological Survey.

\* Measured by engineers of the State of New York Conservation Commission from topographic maps.

*Discharge measurements of Cedar River near Indian Lake, N. Y., for 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
July 15 a...	G. H. Canfield.....	<i>Fect.</i> 47	<i>Sq. ft.</i> 45.4	<i>Fect.</i> 2.52	<i>Sec.-ft.</i> 31.0
Nov. 16 b...	Frank Weber.....	47	73.9	3.05	75.1

a Discharge measurement made under upstream side of bridge by wading.

b Some ice near gage and shore.

*Daily gage height in feet, of Cedar River near Indian Lake, N. Y., for 1911.*

[Frank Van Dusen, observer.]

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.52	2.45	2.60	3.58	4.00	17.....	2.50	2.50	4.05	2.82	3.68	4.65
2.....		2.50	2.45	2.80	3.78	4.00	18.....	2.71	2.50	3.12	2.80	3.90	4.52
3.....		2.50	2.58	2.75	3.95	3.45	19.....	2.55	2.55	3.00	2.85	4.22	3.70
4.....		2.50	2.50	3.35	3.20	3.40	20.....	2.50	2.55	2.80	3.00	4.06	3.50
5.....		2.45	2.50	3.40	3.22	3.45	21.....	2.58	2.50	2.78	3.00	3.50	3.40
6.....		2.45	2.50	3.90	3.25	3.68	22.....	2.55	2.60	2.78	3.00	3.45	3.30
7.....		2.45	2.85	4.00	3.50	3.75	23.....	2.50	2.50	2.80	3.70	3.55	5.90
8.....		2.45	2.85	4.00	3.65	3.75	24.....	2.52	2.50	2.80	4.00	3.80	5.70
9.....		2.45	3.25	3.90	a	3.55	25.....	2.50	2.48	2.50	4.00	3.30	5.05
10.....		2.45	3.45	2.85	a	4.35	26.....	2.45	2.55	2.50	3.25	3.30	4.50
11.....		2.50	3.48	2.85	a	4.65	27.....	2.45	2.50	2.50	3.25	3.28	4.60
12.....		2.50	3.32	2.90	a	6.30	28.....	2.50	2.68	2.45	3.60	3.32	6.20
13.....		2.50	3.25	2.90	a	5.85	29.....	2.55	2.82	2.55	3.30	4.42	.....
14.....		2.48	2.92	2.82	a	5.90	30.....	2.52	2.70	2.60	3.22	4.32	.....
15.....	2.52	2.45	2.88	2.80	a	5.02	31.....	2.52	2.58	.....	3.30	.....	.....
16.....	2.50	2.45	3.10	2.80	3.05	4.92							

a Gage broken off by logs, no record.

NOTE.—Extent of backwater from ice not definitely known. The observer stated that the river was "frozen nearly all over" November 20th, "nearly all open" December 7th, that the ice was "all out of the river" December 14th, and that the river was "all frozen up" on December 29th.

*Indian Lake Reservoir at Indian Lake, N. Y.*

**Location.**—At the masonry storage dam at the outlet of Indian Lake, about  $7\frac{1}{2}$  miles above the confluence of Indian river with the Hudson, and about  $23\frac{1}{2}$  miles above the village of North Creek.

**Records available.**—July 22, 1900, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

**Drainage area.**—One hundred and thirty-one square miles, including about 9.3 square miles of water surface of Indian Lake at the elevation of the spillway of the dam.

**Gage.**—Staff, read once daily. November 17, 1911, a chain gage was installed on the crest of the dam to replace the staff gage. Datum of both gages the same and unchanged since the establishment of the station.

**Discharge measurements.**—The record of this station includes elevation of water surface in the reservoir, depth of water flowing over the spillway or flashboards, depth of opening, and the effective head on each of the 5-foot sluice gates. A meteorological station has also been established at the dam by the United States Weather Bureau and records are kept of the rainfall, temperature, etc. The crest of the dam is 106.65 feet in the clear. To facilitate the calculation of discharge over the spillway, experiments were made at Cornell University in 1899 on a full size model of the spillway section, 6.58 feet long from which the coefficient of discharge has been determined.



No computations of discharge have been made pending current meter measurements to rate discharge through gates. At present record of reservoir level and gate openings alone are obtainable. The elevation of the crest of the spillway above mean tide is 1,650 feet.

*Regulation.*—The flow of the upper Hudson has been controlled to a considerable extent during the dry season by the use of Indian Lake reservoir since its completion in 1899. Total storage provided, about 4.7 billion cubic feet, affording a discharge of nearly 600 second-feet for a period of 90 to 130 days each year.

*Maximum and minimum gage heights.*—Maximum gage height at Indian Lake reservoir since the establishment of the station recorded April 27, 1908, 37.00 feet; minimum gage height recorded March 9 to 18, 1907, and January 3 to 17, 1910, 2.00 feet.

*Co-operation.*—Station maintained in co-operation with the State Engineer and Surveyor of New York and United States Geological Survey.

*Discharge measurements of Indian River at Indian Lake, N. Y., 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 15 ....	G. H. Canfield .....	64	543	a 7.00	856

Gage at Indian Lake Dam read 29.3. One five foot sluice gate open 5 feet; the other open 2½ feet.

a Distance from reference point to water surface.

R. P. is top of eye bar of second span from right abutment down stream side of bridge.

Measurements made at first highway bridge below dam; about 1½ miles down stream.

*Daily gage height, in feet, of Indian Lake, Indian Lake, N. Y., for 1911.*

[Lester Severie, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	11.20	11.45	7.95	6.70	22.10	29.25	32.35	24.40	14.75	13.65	18.05	22.35
2.....	11.15	11.35	7.85	7.00	23.75	29.30	32.35	24.00	14.80	13.55	18.10	22.50
3.....	11.20	11.20	7.70	7.25	24.75	29.35	32.35	23.80	14.85	13.50	18.20	22.60
4.....	11.40	11.10	7.60	7.40	25.15	29.40	32.35	23.40	14.85	13.60	18.30	22.70
5.....	11.46	10.95	7.45	7.55	25.50	29.40	32.35	23.00	14.85	13.90	18.40	22.80
6.....	11.55	10.85	7.25	7.85	25.85	29.60	32.30	22.70	14.80	14.05	18.45	22.85
7.....	11.70	10.70	7.05	8.15	26.10	29.85	32.05	22.20	14.70	14.20	18.70	22.90
8.....	11.80	10.60	6.85	8.55	26.35	30.10	31.80	21.90	14.60	14.40	18.90	23.00
9.....	11.90	10.45	6.65	8.90	26.65	30.15	31.60	21.60	14.60	14.50	19.10	23.10
10.....	12.00	10.35	6.40	9.25	26.85	30.25	31.25	21.10	14.75	14.60	19.30	23.20
11.....	12.10	10.20	6.20	9.55	27.05	30.40	30.90	20.90	14.85	14.70	19.50	23.40
12.....	12.15	10.10	6.05	9.80	27.15	30.65	30.35	20.50	14.85	14.80	19.70	23.70
13.....	12.25	9.95	5.90	10.05	27.30	31.10	30.00	20.10	14.85	14.90	19.90	24.40
14.....	12.35	9.85	5.70	10.45	27.40	31.40	29.60	19.90	14.90	14.90	20.00	25.00
15.....	12.40	9.70	5.65	11.10	27.55	31.70	29.25	19.45	15.05	14.95	20.10	25.45
16.....	12.50	9.60	5.45	11.60	27.65	31.80	28.90	19.00	15.15	15.00	20.25	25.70
17.....	12.55	9.45	5.30	12.15	27.70	31.95	28.60	18.80	15.25	15.05	20.35	25.90
18.....	12.45	9.35	5.15	12.60	27.85	32.10	28.30	18.40	15.25	15.20	20.85	26.20
19.....	12.35	9.20	4.95	13.00	27.95	32.25	28.10	18.00	15.30	15.55	20.90	26.40
20.....	12.20	9.10	4.80	13.40	28.15	32.30	27.80	17.80	15.35	15.90	21.00	26.50
21.....	12.10	8.96	4.65	13.90	28.30	32.35	27.70	17.40	15.20	16.10	21.10	26.60
22.....	11.90	8.85	4.45	14.35	28.40	32.40	27.55	17.00	15.10	16.35	21.15	26.70
23.....	11.85	8.70	4.30	14.75	28.45	32.40	27.25	16.80	14.90	16.60	21.20	27.30
24.....	11.70	8.60	4.15	15.15	28.70	32.45	27.00	16.55	14.75	16.85	21.25	27.70
25.....	11.60	8.45	3.95	15.75	28.85	32.50	26.90	16.10	14.60	17.10	21.45	28.00
26.....	11.45	8.35	3.79	16.50	28.90	32.50	26.60	15.90	14.40	17.30	21.60	28.30
27.....	11.35	8.20	4.00	17.45	29.00	32.35	26.15	15.65	14.25	17.40	21.80	28.60
28.....	11.35	8.10	5.25	18.70	29.10	32.35	25.80	15.40	14.10	17.55	21.85	28.75
29.....	11.40	.....	5.60	19.80	29.15	32.35	25.40	15.15	13.90	17.65	22.00	29.00
30.....	11.50	.....	6.0	21.10	29.15	32.35	25.00	14.90	13.75	17.80	22.20	29.00
31.....	11.60	.....	6.40	.....	29.20	.....	24.80	14.70	.....	17.95	.....	29.20

*Gate openings, in feet, of Indian Lake Reservoir at Indian Lake, N. Y., for 1910-1911.*

DATE. <sup>b</sup>	Sluice gate A open.	Sluice gate B open.	DATE.	Sluice gate A open.	Sluice gate B open.
1910.	<i>Feet.</i>	<i>Feet.</i>	1911.	<i>Feet.</i>	<i>Feet.</i>
January 1-24.....	5.0	5.0	January 1-2.....		5.0
February 8-28.....	5.0	5.0	January 18-27.....		5.0
July 1-11.....	2.5		January 31.....		5.0
August 1-4.....	5.0		February 1-28.....		5.0
August 5-6.....	2.0		March 1-27.....		5.0
August 9-10.....	5.0		March 5-27.....	5.0	5.0
August 11.....	2.0		July 6-31.....		5.0
August 16.....	2.0		July 9-17.....	2.0	
August 17-September 27 <sup>a</sup> ...	5.0		July 28-31.....	2.5	
October 5-November 1.....		5.0	August 1-31.....	2.0	5.0
October 18-November 3.....	2.5		September 5-8.....		5.0
November 2-3.....		2.0	September 20-30.....		5.0
December 5-10.....	2.5		October 1-3.....		5.0
December 1-31.....		5.0			

<sup>a</sup> Main logway open about 9 feet August 31 to Sept. 20, and open 15 feet Sept. 21 to 30, 1910

<sup>b</sup> This table supersedes table published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.

#### SCHROON RIVER DRAINAGE BASIN.

##### *Description.*

Schroon river rises in Essex county, along the southern slopes of the highest mountains in the Adirondack group, flows in a general southerly direction for about 45 miles through Essex and Warren counties, and joins the Hudson near Thurman. Its total drainage area is 550 square miles. Its headwaters reach an elevation of about 2,000 feet above mean tide, while at its mouth it is at an elevation of about 600 feet.

Its basin is largely forested and contains considerable wild land and numerous lakes and ponds. The most important of these is Schroon lake, through which the river flows, which has a water surface area of about 6.3 square miles. The river affords excellent opportunities for storage and power development, which are under investigation by the New York State Water Supply Commission. The only power developments are at Warrensburg.

##### *Schroon Lake at Pottersville, N. Y.*

*Location.*—At the outlet of Schroon lake, 1 mile from Pottersville post-office, 9 miles upstream from the gaging station at Riverbank, N. Y.

*Records available.*—July 8, 1903 (station established) to December 5, 1908; July 1, (date of ice breaking not known), to December 4, 1909; April 17, to December 3, 1910; April 2, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Gage.*—Staff, fastened to steamboat wharf; read once daily. The gage datum was established at an elevation of 803.75 feet above sea level. Datum unchanged.

*Winter records.*—Observations are discontinued each year when the lake freezes and re-established in the spring as soon as the ice breaks. (See Records available.)

*Co-operation.*—Established and maintained by United State Geological Survey in co-operation with the State of New York Conservation Commission.

*Daily gage height, in feet, of Schroon Lake, Pottersville, N. Y., for 1911.*  
[Hannah Nichols, observer.]

DAY.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
1.		6.6	3.6	2.1	0.8	0.4	0.5		2.7
2.	1.6	6.65	3.5	1.9	.8	.4	.6		2.7
3.	1.6	6.7	3.4	1.9	.7	.4	.6		2.7
4.	1.7	6.6	3.4	1.8	.7	.4	.6		2.7
5.	1.7	6.45	3.4	1.8	.7	.4	.7		2.7
6.	1.7	6.1	3.4	1.8	.7	.4	.7		2.7
7.	1.9	5.9	3.4	1.7	.7	.4	.7		2.7
8.	1.1	5.7	3.4	1.7	.6	.4	.7		2.7
9.	2.0	5.5	3.4	1.6	.6	.5	.7		2.7
10.	2.6	5.2	3.4	1.5	.6	.4	.7		2.7
11.	3.0	4.9	3.4	1.3	.5	.4	.7		2.9
12.	3.8	4.8	3.5	1.3	.5	.5	a	52.6	2.9
13.	4.85	4.75	3.5	1.1	.5	.5		2.6	3.4
14.	5.3	4.7	3.5	1.1	.5	.5		2.7	3.6
15.	5.8	4.5	3.6	1.1	.5	.6		2.9	4.0
16.	6.3	4.3	3.6	1.1	.5	.6		3.0	4.5
17.	6.5	4.2	3.6	1.1	.5	.6		3.0	4.7
18.	6.5	4.0	3.45	1.1	.5	.7		3.0	4.9
19.	6.4	4.0	3.2	1.1	.5	.5		3.0	4.9
20.	6.4	4.0	3.1	1.0	.5	.5		2.9	5.0
21.	6.3	4.0	3.0	1.0	.5	.4		2.9	5.1
22.	6.3	4.0	2.9	1.0	.5	.4		2.9	5.2
23.	6.2	4.0	2.8	1.0	.5	.4		2.8	5.3
24.	6.1	4.0	2.8	.9	.4	.4		2.8	5.3
25.	6.2	4.0	2.7	.9	.4	.4		3.0	5.4
26.	6.3	4.0	2.6	.9	.4	.35		2.8	5.45
27.	6.3	4.0	2.5	.8	.4	.35		2.7	5.00
28.	6.4	4.0	2.4	.8	.4	.3		2.7	5.70
29.	6.5	3.9	2.2	.8	.4	.3		2.7	5.75
30.	6.5	3.8	2.1	.8	.4				5.80
31.		3.7		.8					

a Gage removed, making repairs to dock.

b Gage installed by local parties; datum uncertain; indicates rate lake was filling to end of December.

#### *Schroon River at Riverbank, N. Y.*

*Location.*—At the highway bridge 12 miles above the confluence of Schroon river with the Hudson, 9 miles below the mouth of Schroon lake, about 3½ miles below the outlet of Grant lake (coming in from the left), and 1 mile below Tumblehead falls which extends upstream about a mile farther. The station is about 9 miles north of Warrensburg where there are several dams used for power development.

*Records available.*—September 2, 1907, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—534 square miles.

*Gage.*—Chain; read once daily; datum unchanged.

*Channel.*—Gravel; smooth and permanent.

*Discharge measurements.*—Made from bridge.

*Artificial control.*—Since 1907 the regimen of flow of Schroon river, from the low water period to the high, has been somewhat affected by storage in Schroon lake. In September, 1907, a timber crib dam was constructed at Starbuckville about 6 miles above the station. This dam affords a head of about 8 feet and ponds water to Schroon lake.

*Winter flow.*—Affected by ice. Measurements made through the ice have developed a fairly good ice discharge curve.

*Accuracy.*—Open water curve well developed.

*Co-operation.*—Established and maintained by United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Schroon River at Riverbank, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. Ft.</i>	<i>Feet.</i>	<i>Sec. Ft.</i>
Jan. 20 a.....	F. J. Shuttleworth.....	66	244	2.33	370
Feb. 26 b.....	F. J. Shuttleworth.....	63	198	2.04	250
June 8 c.....	C. S. De Golyer.....	73	247	3.00	698
Sept. 1 d.....	Frank Weber.....	46	75.0	1.22	111
Sept. 1 d.....	G. H. Canfield.....	46	71.1	1.18	99.9
Sept. 1 d.....	G. H. Canfield.....	59	47.5	1.16	94.1

a Measurement made under complete ice cover. Average thickness of ice 1.21 feet. Gage height to top of ice 2.40 feet.

b Measurement made under complete ice cover. Average thickness of ice 1.29 feet. Gage height to top of ice 2.20 feet.

c Logs in river caused back water at gage.

d Measurements made by wading below the gage.

*Daily gage height, in feet, of Schroon River at Riverbank, N. Y., for 1911.*

[J. H. Roberts, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.85	2.25	2.1	2.5	5.2	2.6	1.7	1.3	1.2	1.4	2.35	2.65
2.....	1.85	2.3	2.05	2.35	5.2	2.4	1.65	1.3	1.2	1.4	2.4	2.6
3.....	2.0	2.3	2.0	2.6	5.5	2.35	1.6	1.25	1.2	1.4	2.4	2.6
4.....	2.05	2.4	1.95	2.55	5.4	2.3	2.15	1.25	1.12	1.45	2.4	2.65
5.....	2.1	2.25	1.9	2.6	5.0	2.9	2.15	1.25	1.15	1.45	2.35	2.55
6.....	2.1	2.35	1.95	2.85	4.8	3.2	2.15	1.2	1.15	1.5	2.4	2.5
7.....	2.05	2.4	1.85	3.1	4.4	3.2	2.1	1.25	1.12	1.6	2.4	2.5
8.....	2.1	2.3	1.9	3.2	4.2	3.3	1.7	1.25	1.12	1.8	2.32	2.5
9.....	2.4	2.15	1.95	3.2	4.2	3.2	1.4	1.25	1.3	1.8	2.32	2.5
10.....	2.3	2.2	1.95	3.6	4.1	3.1	1.6	1.25	1.55	1.75	2.5	2.45
11.....	2.3	2.2	1.8	3.8	3.9	2.0	1.45	1.25	1.45	1.8	2.45	2.5
12.....	2.3	2.2	1.65	4.1	3.8	3.2	1.35	1.15	1.5	1.75	2.45	2.5
13.....	2.25	2.4	1.75	4.3	3.7	3.2	1.3	1.2	1.6	1.7	2.55	2.7
14.....	2.3	2.35	1.8	4.4	3.4	3.2	1.3	1.15	1.48	1.7	2.65	3.1
15.....	2.3	2.3	1.95	5.1	3.4	3.2	1.35	1.15	1.5	1.6	2.7	3.2
16.....	2.4	2.2	2.0	5.4	3.4	3.2	1.2	1.15	1.5	1.6	2.8	3.3
17.....	2.4	2.25	2.05	5.5	3.3	3.3	1.25	1.15	1.48	1.65	2.7	3.5
18.....	2.35	2.25	1.9	5.4	3.3	2.9	1.3	1.2	1.48	1.8	2.8	3.6
19.....	2.3	2.15	1.75	5.4	3.4	3.0	1.4	1.2	1.5	2.2	2.75	3.6
20.....	2.3	2.25	1.9	5.3	3.4	2.75	1.4	1.15	1.45	2.2	2.8	3.6
21.....	2.25	2.25	1.95	5.3	2.85	2.65	1.4	1.15	1.45	2.2	2.8	3.5
22.....	2.2	2.3	1.9	5.2	2.9	2.65	1.35	1.15	1.48	2.2	2.7	3.6
23.....	2.3	2.25	1.9	5.1	2.95	2.55	1.3	1.1	1.45	2.42	2.75	3.8
24.....	2.45	2.3	1.95	5.0	3.2	2.25	1.45	1.1	1.35	2.35	2.7	3.9
25.....	2.4	2.25	2.0	5.0	3.6	2.3	1.35	1.05	1.38	2.4	2.7	4.1
26.....	2.4	2.35	1.8	5.0	2.95	2.35	1.3	1.05	1.45	2.4	2.65	4.1
27.....	2.4	2.2	2.15	5.0	3.4	2.4	1.35	1.05	1.45	2.4	2.65	4.1
28.....	2.45	2.15	2.35	5.2	2.3	2.3	1.35	1.1	1.4	2.35	2.65	4.1
29.....	2.15	.....	2.35	5.2	2.35	2.25	1.4	1.15	1.42	2.36	2.65	4.0
30.....	2.35	.....	2.45	5.2	2.3	2.2	1.25	1.1	1.4	2.4	2.65	4.0
31.....	2.3	.....	2.5	.....	3.2	.....	1.3	1.1	.....	2.4	.....	3.6

NOTE.—Relation of gage height to discharge doubtless affected by ice from January 1 to about March 18. Back-water from ice during December improbable. Gage readings were probably taken to the surface of the water. Back-water from log jams may have existed during the greater part of the open-water period. The plotting of the measurement made June 8 indicates that there was back-water during May and June.

*Daily discharge in second-feet of Schroon River, at Riverbank, N. Y., for 1910.*

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		5,460	1,940	2,470	694	136	331	432	411	294
2.....		5,420	1,870	2,270	259	164	350	390	432	312
3.....		5,060	1,970	2,000	226	136	390	432	390	331
4.....		4,620	1,890	1,840	259	350	350	411	411	259
5.....		4,220	1,970	1,730	608	210	350	411	476	276
6.....		3,880	2,080	1,840	499	178	390	411	454	276
7.....		3,740	2,160	1,800	499	164	390	390	476	312
8.....		3,540	2,000	2,050	432	178	411	370	476	.....
9.....		3,340	2,050	2,050	432	178	390	350	476	.....
10.....		3,040	2,000	2,000	350	164	370	370	476	.....
11.....		2,500	1,940	1,840	350	178	331	370	476	.....
12.....		2,000	1,940	1,840	226	164	350	390	454	.....
13.....	2,096	2,166	1,890	1,670	242	149	390	370	411	.....
14.....	1,910	2,000	1,840	1,400	242	122	194	350	454	.....
15.....	1,780	1,890	1,520	1,200	210	164	164	350	411	.....
16.....	1,670	1,760	1,520	1,240	226	178	178	294	390	.....
17.....	1,570	1,650	1,400	1,200	178	164	350	390	411	.....
18.....	1,470	1,400	966	1,120	194	164	331	390	432	.....
19.....	1,310	1,550	966	1,080	178	164	331	370	432	.....
20.....	1,270	1,910	933	1,000	178	149	312	350	312	.....
21.....	1,220	2,380	980	966	164	149	294	312	390	.....
22.....	1,220	2,470	836	933	149	164	312	331	390	.....
23.....	1,340	2,350	913	868	194	226	294	294	390	.....
24.....	1,596	2,220	1,160	836	136	242	294	312	294	.....
25.....	2,220	2,190	1,200	776	149	226	370	331	350	.....
26.....	2,940	2,100	1,940	694	136	210	370	331	350	.....
27.....	3,380	2,190	1,870	806	149	178	411	331	276	.....
28.....	3,870	2,130	2,106	806	149	194	522	390	312	.....
29.....	3,020	2,100	2,000	836	136	226	499	411	276	.....
30.....	4,700	2,050	2,330	748	122	210	432	350	294	.....
31.....	5,140	.....	2,420	.....	97	276	.....	411	.....	.....

NOTE.— Discharge January 1 to March 12, and December 8 to 31, as published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York, has not been revised but is not published in this report because the values are only approximate, due to the presence of ice.

Daily discharge determined from a well-defined discharge rating curve.

*Daily discharge in second-feet of Schroon River at Riverbank, N. Y., for 1911.*

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		568	3,040	495	242	130	105	156	499	643
2.....		499	3,040	395	226	130	105	156	522	618
3.....		618	3,400	372	212	118	105	156	522	618
4.....		593	3,280	350	411	118	86	170	522	643
5.....		618	2,800	645	411	118	93	170	499	593
6.....		749	2,560	815	411	105	93	184	522	568
7.....		900	2,100	815	390	118	86	212	522	568
8.....		966	1,890	875	242	118	86	276	485	568
9.....		966	1,890	815	156	118	130	276	485	568
10.....		1,290	1,780	755	212	118	198	259	568	545
11.....		1,470	1,570	235	170	118	170	276	545	568
12.....		1,780	1,470	815	143	93	184	259	545	568
13.....		2,000	1,380	815	130	105	212	242	593	668
14.....		2,100	935	815	130	93	178	242	643	900
15.....		2,920	935	815	143	93	184	212	668	966
16.....		3,280	935	815	105	93	184	212	721	1,040
17.....		3,400	875	875	118	93	178	226	668	1,200
18.....		3,280	875	645	130	105	178	276	721	1,290
19.....	259	3,280	935	700	156	105	184	432	694	1,290
20.....	312	3,160	935	694	156	93	170	432	721	1,290
21.....	331	3,160	620	643	156	93	170	432	721	1,200
22.....	312	3, 40	645	643	143	93	178	432	668	1,290
23.....	312	2,920	673	593	130	81	170	531	694	1,470
24.....	331	2,800	815	454	170	81	143	499	668	1,570
25.....	350	2,800	1,065	476	143	70	151	522	668	1,780
26.....	276	2,800	673	499	130	70	170	522	643	1,780
27.....	411	2,800	935	522	143	70	170	522	643	1,780
28.....	499	3,040	350	476	143	81	156	499	643	1,780
29.....	499	3,040	372	454	156	93	162	499	643	1,670
30.....	545	3,040	350	432	118	81	156	522	643	1,670
31.....	568	.....	815	.....	130	81	.....	522	.....	1,290

NOTE.— Daily discharge determined from two discharge rating curves; the 1910 curve, applied March 19 to May 13 and June 20 to December 31, and a curve based on a measurement made June 8, applied May 14 to June 19. It is not known to what extent other determinations of daily discharge may be in error, as a result of back-water from log jams not reported by the observer.

*Monthly discharge of Schroon River at Riverbank, N. Y., for 1910.*  
[Drainage area, 534 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				Run-off depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....			188	.352	.41	D
February.....			363	.680	.70	C
March.....	5,140		1,910	3.58	4.13	B
April.....	5,460	1,400	2,780	5.21	5.81	A
May.....	2,420	836	1,700	3.18	3.67	A
June.....	2,470	694	1,400	2.62	2.92	A
July.....	694	97	260	.487	.56	A
August.....	350	122	186	.348	.40	A
September.....	522	164	348	.652	.73	A
October.....	432	294	368	.689	.79	A
November.....	476	276	399	.747	.83	A
December.....	331		219	.410	.47	C
The year.....	5,460	97	843	1.58	21.42	

NOTE.— Discharge January 1 to March 12, and December 8 to 31 has been computed from a special discharge rating curve based on three discharge measurements made with ice present. Daily discharge for these periods as published in the Annual Report of the N. Y. State Water Supply Commission has not been revised in the Federal report. They are not published, however, because they are very approximate. The discharge during each of the three months—January, February and December—was probably quite uniform.

Mean discharge March 1 to 12 estimated 1,280 second-feet, ranging from 579 to 2,060.

Mean discharge December 8 to 31 estimated 197 second-feet.

Discharge for May probably somewhat too high as a result of back-water from log jams.

*Monthly discharge of Schroon River at Riverbank, N. Y., for 1911.*  
[Drainage area, 534 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				Run-off depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....			357	.669	.77	D
February.....			250	.468	.49	D
March.....	568		310	.581	.67	C
April.....	3,400	499	2,130	3.99	4.45	A
May.....	3,400	350	1,420	2.66	3.07	B
June.....	875	235	625	1.17	1.30	B
July.....	411	105	189	.354	.41	B
August.....	130	70	99.2	.186	.21	B
September.....	212	86	151	.283	.32	B
October.....	531	156	333	.624	.72	B
November.....	721	485	610	1.14	1.27	B
December.....	1,780	545	1,060	1.99	2.29	B
The year.....	3,400	70	628	1.18	15.97	

NOTE.— Discharge January 1 to March 18 estimated by means of discharge at other stations in the upper Hudson River basin, climatological records, and two discharge measurements made during the period.

Mean discharge March 1 to 18 estimated, 260 second-feet.

## SACANDAGA RIVER DRAINAGE BASIN.

*Description.*

Sacandaga river is formed by three principal branches which unite in the southeastern part of Hamilton county in the Adirondack region. The west branch is the outlet of Piseco lake, the middle branch is the outlet of Sacandaga and Pleasant lakes, while the east and principal branch issues from a series of small ponds and lakes in the southwestern part of Warren county. The east and middle branches unite a few miles north of Wells and are joined by the west branch a short distance below Wells. The river then flows southeasterly to a point about 5 miles below Northville, where it turns and runs northeasterly to the Hudson river at Hadley. Its total drainage area comprises about 1,050 square miles.

Sacandaga lake, the highest of the tributary lakes in the headwaters, is about 1,700 feet above mean tide; at its entrance into the Hudson the Sacandaga is at an elevation of about 550 feet. Between Northville and the mouth of the river there is a fall of about 180 feet (chiefly concentrated in the 5 miles below Conklingville) entirely unutilized. There are, in fact, no power developments on the Sacandaga.

The drainage area of this river is largely in forest. Precipitation is high, the mean for the year being about 49 inches, whereas that of the whole Hudson drainage area above Mechanicville is only about 43 inches. Possibilities for storage on the Sacandaga are great and the New York State Conservation Commission proposes a high dam at Conklingville, the reservoir to store about 29,000,000,000 cubic feet of water, with a water surface of about 40 square miles, and controlling practically the entire flow of the Sacandaga basin. Their plan proposes also to develop the total fall obtained between Conklingville and the Hudson—approximately 200 feet—which will afford 25,000 to 30,000 continuous horsepower.

*Sacandaga River at Wells, N. Y.*

*Location.*—At the lower highway bridge in the village of Wells, 1 mile below the mouth of Elbow Creek and  $2\frac{1}{2}$  miles above the mouth of West Branch Sacandaga river, both streams entering from the right.

*Records available.*—August 25, 1907, to September 30, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York. This station was discontinued September 30, 1911.

*Drainage area.*—263 square miles.

*Gage.*—Chain; read twice daily; datum unchanged.

*Channel.*—Rough and permanent.

*Discharge measurements.*—Made from the bridge and by wading.

*Artificial control.*—There are no mills of any importance above the station. There are, however, several small storage reservoirs which hold back water for short periods to be used for logging. The release of this water has little effect on the daily gage readings. During the summer of 1911 a timber dam about 10 feet high was constructed about one-half mile below the station on the site of an old dam formerly used for milling purposes. The new dam, which furnishes power for a hardwood veneer mill, was put in operation August 28, 1911, and caused back-water at the gaging station.

*Winter flow.*—Affected by ice.

*Accuracy.*—The low water and middle stage parts of the discharge rating curve are very well developed; but owing to the velocity of the water and the roughness of the channel, it is difficult to get accurate measurements at high stages, and determinations based on gage heights above 7 feet may be somewhat in error. Determinations of discharge prior to 1910, particularly those for stages above gage heights, 5.5 feet, have been revised from information obtained during the high-water period of 1911. Gage readings subsequent to August 28, 1911, are of no value except as they show the effect of back-water from the new dam.

*Co-operation.*—Established and maintained by United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Sacandaga River at Wells, N. Y., in 1907 and 1910.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec. ft.</i>
1907.					
Nov. 8a.....	J. B. Pierson.....	95	384	7.5	2,670
1910.					
March 26c.....	W. G. Hoyt.....	100	530	8.5	3,250
March 27c.....	W. G. Hoyt.....	98	438	7.58	2,390
March 28c.....	W. G. Hoyt.....	98	428	7.55	2,420
Mar. 29c.....	W. G. Hoyt.....	97	530	8.5	3,160
June 8.....	W. G. Hoyt.....	91	351	6.54	1,400
June 9.....	W. G. Hoyt.....	89	319	6.3	1,170

a Measurement made with surface floats near bridge. Revised on the basis of a coefficient of .72.

c Sub-surface measurement; a coefficient of .72 used to reduce surface velocities to mean in vertical.

NOTE.—Some of the discharge measurements for 1910, as published in the annual reports of the State Water Supply Commission of New York and State Engineer and Surveyor, State of New York, revised from vertical velocity curve measurements, which indicate that a coefficient of .72 should be applied to all measurements made by the sub-surface method. Measurements revised on this basis published above.

*Discharge measurements of Sacandaga River at Wells, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec. ft.</i>
Jan. 26a.....	F. J. Shuttleworth.....	73	149	4.95	194
Mar. 13b.....	C. S. DeGolyer.....	74	151	4.37	166
April 19c.....	E. S. Cullings.....	90	358	6.95	1,660
April 20c.....	E. S. Cullings.....	90	356	7.00	1,740
April 25c.....	W. G. Hoyt.....	92	370	6.83	1,700
July 23d.....	C. S. DeGolyer.....	46	56	3.96	47

a Discharge measurement made under partial ice cover.

b River practically free of ice above gage and for 300 feet below gage.

c Discharge measurement made by wading one-half mile up stream.

d Discharge measurement made by sub-surface method, using a coefficient of .72 to reduce surface velocities to mean velocities.



## FIRST ANNUAL REPORT OF THE

Daily gage height in-feet of Sacandaga River at Wells, N. Y., for 1911.

[Frank Stanyon, observer]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.
1.....	6.8	5.2	4.7	5.3	7.8	5.45	4.40	3.82	6.4
2.....	6.7	5.2	4.7	5.2	8.4	5.35	4.36	3.82	7.2
3.....	7.2	5.25	4.6	5.1	7.6	5.3	4.32	3.86	7.0
4.....	7.2	5.2	4.6	5.1	7.5	5.3	4.32	3.78	8.1
5.....	7.2	5.3	4.5	5.1	7.6	5.3	4.28	3.75	9.9
6.....	7.2	5.3	4.5	5.3	7.2	5.4	4.22	3.74	10.2
7.....	7.0	5.2	4.48	6.15	6.4	5.75	4.15	3.71	10.2
8.....	6.7	5.2	4.48	6.6	7.2	5.9	4.08	3.70	10.3
9.....	6.6	5.2	4.45	6.3	7.0	5.6	4.00	3.69	10.5
10.....	6.5	5.1	4.42	6.3	6.4	5.35	4.00	3.68	10.2
11.....	6.25	5.1	4.40	6.3	6.4	5.2	3.92	3.64	10.1
12.....	6.1	5.1	4.42	6.5	6.4	5.65	3.90	3.60	10.1
13.....	5.85	5.1	4.45	6.7	6.4	6.6	3.95	3.60	10.1
14.....	5.9	5.0	4.65	7.1	6.4	6.9	3.90	3.62	10.1
15.....	5.8	5.0	4.45	7.6	6.4	6.4	3.85	3.62	10.2
16.....	5.7	5.05	4.55	7.1	6.4	5.95	3.88	3.60	10.4
17.....	5.6	5.0	4.6	6.8	6.4	5.65	3.88	3.64	10.2
18.....	5.45	5.0	4.6	6.8	6.35	5.5	3.88	3.60	10.1
19.....	5.3	4.9	4.6	6.9	6.3	5.25	3.92	3.60	10.0
20.....	5.2	4.9	4.5	7.0	6.4	5.1	3.90	3.62	10.0
21.....	5.2	4.9	4.5	7.0	6.3	4.9	3.92	3.60	10.0
22.....	5.15	4.8	4.6	6.7	6.45	4.9	3.90	3.62	10.0
23.....	5.1	4.8	4.6	6.5	6.4	4.8	3.80	3.64	10.0
24.....	5.0	4.75	4.6	6.35	6.4	4.8	3.98	3.60	10.0
25.....	5.0	4.75	4.6	6.9	6.35	4.7	4.00	3.59	10.0
26.....	4.98	4.7	4.65	7.5	6.4	4.6	3.94	3.58	10.0
27.....	4.98	4.7	4.85	7.9	6.35	4.5	3.88	3.59	10.1
28.....	5.1	4.68	4.5	8.1	6.0	4.5	3.88	3.95	10.1
29.....	5.25	.....	5.85	8.8	5.75	4.46	3.92	8.2	10.1
30.....	5.2	.....	5.6	8.0	5.7	4.42	3.94	6.2	10.1
31.....	5.2	.....	5.4	.....	5.48	.....	3.94	6.1	.....

NOTE.—Relation of gage height to discharge doubtless affected by ice from January 1 to about March 10. The gage readings were probably to water surface. The gage heights were probably more or less affected by back-water from log jams during April, May, and June. Beginning August 29, the gage heights do not correctly indicate the discharge, as the station was flooded out by back-water from the newly constructed dam below.

Daily discharge, in second-feet, of Sacandaga River at Wells, N. Y., for 1907.

DAY.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	.....	25	186	748	380	17.....	.....	118	425	530	.....
2.....	.....	25	176	780	358	18.....	.....	100	380	475	.....
3.....	.....	33	208	2,350	358	19.....	.....	86	337	450	.....
4.....	.....	297	192	1,800	358	20.....	.....	86	337	425	.....
5.....	.....	402	450	1,100	337	21.....	.....	83	317	402	.....
6.....	.....	260	360	1,460	337	22.....	.....	86	317	530	.....
7.....	.....	192	425	2,940	337	23.....	.....	73	297	475	.....
8.....	.....	116	337	2,540	317	24.....	.....	118	297	475	.....
9.....	.....	105	337	1,890	317	25.....	25	176	260	475	.....
10.....	.....	132	450	1,260	297	26.....	25	146	225	475	.....
11.....	.....	225	402	1,030	1,060	27.....	25	118	242	475	.....
12.....	.....	750	360	990	1,800	28.....	24	105	1,460	450	.....
13.....	.....	402	650	850	1,060	29.....	23	176	1,620	425	.....
14.....	.....	242	530	682	590	30.....	23	167	1,060	425	.....
15.....	.....	176	475	620	.....	31.....	23	.....	1,290	.....	.....
16.....	.....	118	450	560	.....						

*Daily discharge in second-feet of Sacandaga River at Wells, N. Y., for 1908.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	450		475	1,540	3,560	715	77	32	16	43	129	188
2.....			425	1,380	5,210	780	70	26	16	64	121	161
3.....			425	1,260	2,840	590	64	25	16	68	105	95
4.....			450	955	2,840	530	60	29	16	68	64	225
5.....			450	885	3,140	530	64	31	15	45	68	173
6.....			450	990	2,540	475	60	46	14	39	60	129
7.....			380	1,380	2,260	402	70	50	16	37	53	225
8.....			358	2,070	2,350	380	86	45	16	29	48	475
9.....			358	2,940	2,160	358	73	33	16	27	46	560
10.....			358	2,540	1,460	358	60	41	14	25	46	530
11.....			358	3,140	2,840	337	52	36	14	64	70	475
12.....			380	2,640	1,540	297	46	29	14	53	155	450
13.....			402	2,160	1,300	260	43	28	13	48	135	402
14.....			402	2,640	990	242	41	32	12	41	108	380
15.....	1,890		920	2,350	1,220	225	36	29	12	37	105	358
16.....	3,560	1,030	1,620	1,220	192	31	28	12	32	105	317	
17.....	2,070	955	1,460	990	176	33	29	12	31	79	278	
18.....	1,460	850	1,260	1,140	192	138	33	12	29	73	225	
19.....	1,340	748	1,980	715	225	167	31	12	26	70	225	
20.....	1,100	682	1,890	715	225	100	31	11	25	86	225	
21.....	955	590	1,710	590	186	75	30	10	24	93	192	
22.....	955	590	1,710	748	161	81	25	10	23	75	186	
23.....	780	560	2,070	650	146	68	29	10	23	77	192	
24.....	682	682	3,560	715	146	57	25	11	25	79	192	
25.....	650	885	4,000	850	146	50	22	11	25	116	180	
26.....	530	850	3,670	486	126	60	21	10	38	192	176	
27.....	530	1,800	3,890	560	100	62	20	11	278	402	180	
28.....	530	2,260	3,560	530	93	57	18	12	161	297	176	
29.....	475	3,350	3,140	530	86	58	17	111	260	161	173	
30.....	2,350	3,040	530	79	46	17	17	77	225	149	180	
31.....	1,890			685		33	17		161		186	

NOTE.—Daily discharge for 1907 and 1908 determined from a well-defined discharge rating curve. Tables supersede those published in the New York State and Federal reports.

*Daily discharge in second-feet of Sacandaga River at Wells, N. Y., for 1909.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	189	300	1,060	530	1,620	530	110	38	23	37	28	79
2.....	186	300	885	650	2,440	530	103	32	23	31	28	75
3.....	176	300	780	885	1,620	475	167	32	22	28	28	64
4.....	189	300	715	955	2,070	475	144	30	22	26	29	64
5.....	242	300	583	920	1,620	560	116	29	23	25	31	57
6.....	1,050	300	650	1,380	2,440	1,060	103	29	23	24	31	64
7.....	700	1,000	590	3,240	3,780	850	91	28	22	23	27	70
8.....	500	800	560	3,670	2,540	620	79	27	21	22	24	60
9.....	500	700	530	3,140	1,380	502	73	26	19	21	21	81
10.....	400	640	502	2,260	2,540	530	68	26	21	21	22	138
11.....	440	800	530	1,540	3,350	850	64	25	23	21	27	86
12.....	310	700	502	1,380	2,350	590	58	24	22	22	29	77
13.....	280	600	475	2,070	2,160	560	52	23	21	22	29	76
14.....	300	550	502	5,320	2,160	590	50	23	20	23	29	65
15.....	360	650	530	4,440	1,980	475	50	27	19	24	29	65
16.....	390	700	530	3,560	1,620	380	45	41	19	27	29	65
17.....	340	600	475	3,140	1,300	297	50	118	18	29	36	65
18.....	300	600	425	3,460	1,100	380	52	127	18	29	41	65
19.....	260	500	475	3,460	1,180	380	53	105	18	29	43	65
20.....	230	1,500	450	3,400	1,140	450	50	77	18	29	45	65
21.....	200	2,800	402	2,080	1,140	380	50	60	18	28	50	65
22.....	175	2,250	402	2,760	1,030	297	53	53	17	46	50	65
23.....	175	1,350	402	2,580	815	260	86	50	17	57	81	65
24.....	250	1,120	380	2,420	620	225	127	41	23	45	108	65
25.....	1,400	2,400	380	1,620	590	208	135	30	25	38	108	65
26.....	1,400	1,600	475	1,920	590	186	110	27	25	36	121	65
27.....	1,000	1,200	450	2,330	590	176	77	26	26	36	155	65
28.....	700	1,200	475	2,420	650	161	60	24	31	31	118	65
29.....	600		530	2,500	650	135	53	25	38	33	93	65
30.....	500		450	2,160	590	116	46	23	41	27	86	65
31.....	400		475		560		45	23		28		65

## FIRST ANNUAL REPORT OF THE

Daily discharge in second-feet of Sacandaga River at Wells, N. Y., for 1910.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sépt.	Oct.	Nov.	Dec.
1.....			3,240	3,670	920	1,800	146	46	52	530	297	155
2.....			2,940	3,350	885	1,620	149	43	60	425	278	155
3.....			2,350	2,540	990	1,460	129	46	93	358	297	
4.....			1,890	2,260	1,030	1,380	110	278	260	317	380	
5.....			1,620	2,350	990	1,460	103	475	225	260	650	
6.....			1,540	2,260	990	1,710	81	260	260	260	650	
7.....			1,620	2,160	990	1,980	43	146	225	242	620	
8.....			1,340	1,800	920	(1,500)	60	111	176	225	590	
9.....			1,260	1,340	920	1,060	53	95	146	225	530	
10.....			1,220	935	780	920	43	93	116	225	475	
11.....			1,140	905	708	920	50	380	95	186	450	
12.....			990	850	715	1,140	43	278	81	161	425	
13.....			920	1,140	650	1,060	42	176	83	192	337	
14.....			850	1,080	650	780	38	127	127	192	297	
15.....			748	670	650	650	36	110	110	186	278	
16.....			650	720	715	560	41	337	95	173	260	
17.....			650	720	650	650	60	297	81	161	260	
18.....			620	1,620	715	715	58	278	70	146	225	
19.....			620	2,670	815	590	52	225	73	138	208	
20.....			590	2,000	780	475	45	176	68	138	225	
21.....	475		780	745	955	380	41	138	60	138	208	
22.....	2,070		1,140	745	850	297	46	127	58	155	192	
23.....	1,540		1,980	822	850	297	60	110	53	260	192	
24.....	1,140		2,840	298	1,060	260	55	95	50	208	208	
25.....	1,050		3,350	545	1,460	225	52	100	132	225	192	
26.....	780		3,460	885	2,070	192	53	91	402	260	186	
27.....	560		2,350	780	1,460	192	53	81	2,440	317	186	
28.....	475		2,260	885	1,060	176	60	70	1,460	530	167	
29.....	425		3,140	920	990	180	83	64	1,140	475	167	
30.....	425		3,780	920	1,060	156	64	60	920	475	161	
31.....	475		3,780		1,060		52	60		337		

NOTE.— Daily discharge for 1909 and 1910 determined from a well-defined rating curve. Tables supersede those published in the New York State and Federal reports for 1909 in the Sixth Annual Report of the New York State Water Supply Commission and in the 1910 report of the New York State Engineer and Surveyor.

Daily discharge January 6 to February 28, and December 13 to 31, 1909, when ice was present determined by means of climatological records and a comparison of discharge of Sacandaga River stations. Discharge April 20 to 29, 1909, corrected for effect of back-water from log jam.

Discharge April 10 to 25, 1910, determined from a special curve obtained from two measurements made during that period, when back-water caused by log jam existed.

Daily discharge in second-feet of Sacandaga River, at Wells, N. Y., for 1911.

DAY.	Mar.	April.	May.	June.	July.	Aug.	DAY.	Mar.	April.	May.	June.	July.	Aug.
1.....		530	2,540	620	161	33	17.....	225	1,620	1,300	748	41	19
2.....		475	2,330	560	149	33	18.....	225	1,620	1,260	650	41	17
3.....		425	1,700	530	138	38	19.....	225	1,710	1,220	502	46	17
4.....		425	1,620	530	138	29	20.....	192	1,800	1,300	425	43	18
5.....		425	1,700	530	127	27	21.....	192	1,800	1,220	337	46	17
6.....		530	1,410	590	110	26	22.....	225	1,540	1,340	337	43	18
7.....		1,100	905	815	93	24	23.....	225	1,380	1,300	297	31	19
8.....		1,460	1,410	920	77	23	24.....	225	1,260	1,300	297	57	17
9.....		1,220	1,280	715	60	22	25.....	225	1,710	1,260	260	60	16
10.....		1,220	1,300	560	60	22	26.....	242	2,260	1,300	225	50	16
11.....	161	1,220	1,300	475	46	19	27.....	317	2,640	1,260	192	41	16
12.....	167	1,380	1,300	748	43	17	28.....	192	2,840	990	192	41	52
13.....	176	1,540	1,300	1,460	52	17	29.....	885	3,560	815	180	46	(100)
14.....	242	1,890	1,300	1,710	43	18	30.....	715	2,740	780	167	50	(160)
15.....	176	2,350	1,300	1,300	37	18	31.....	590		648		50	(140)
16.....	208	1,890	1,300	955	41	17							

NOTE.— Daily discharge determined from a well-defined discharge rating curve. The discharge is determined from the same rating curve used to compute revised estimates for this station published in Water-Supply Paper No. 281. Daily discharge August 29, 30, and 31 estimated from the discharge at Hadley. Daily discharge May 2 to 9 reduced on account of the backwater from log jam.

CONSERVATION COMMISSION.

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*Monthly discharge of Sacandaga River at Wells, N. Y., for 1907.*  
[Drainage area, 263 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
August 25-31.....	25	23	24.0	.091	.02	B
September.....	780	25	172	.654	.73	A
October.....	1,620	176	479	1.82	2.10	A
November.....	2,940	402	936	3.56	3.97	A
December.....	1,800	297	749	2.85	3.29	C

*Monthly discharge of Sacandaga River at Wells, N. Y., for 1908.*  
[Drainage area, 263 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....			450	1.71	1.97	D
February.....	3,560		724	2.75	2.98	C
March.....	3,350	358	844	3.21	3.70	A
April.....	4,000	885	2,250	8.56	9.55	A
May.....	5,210	480	1,550	5.89	6.79	A
June.....	780	79	292	1.11	1.24	A
July.....	167	31	65.1	.248	.29	B
August.....	50	17	29.2	.111	.13	B
September.....	111	10	18.4	.070	.08	B
October.....	278	23	66.9	.254	.29	B
November.....	402	46	112	.426	.48	A
December.....	560	95	262	.996	1.15	C
The year.....	5,210	10	554	2.11	28.64	

*Monthly discharge of Sacandaga River at Wells, N. Y., for 1909.*  
[Drainage area, 263 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....			456	1.73	1.99	D
February.....			931	3.54	3.69	D
March.....	1,060	380	535	2.04	2.35	A
April.....	5,320	530	2,410	9.17	10.23	B
May.....	3,780	560	1,560	5.93	6.84	A
June.....	1,060	116	441	1.68	1.87	A
July.....	167	45	78.1	.297	.34	B
August.....	127	23	40.9	.156	.18	B
September.....	41	17	22.5	.086	.10	B
October.....	57	21	29.6	.113	.13	B
November.....	155	21	52.5	.200	.22	B
December.....	138	57	69.7	.265	.31	D
The year.....	5,320	17	54.6	2.09	28.25	

## FIRST ANNUAL REPORT OF THE

*Monthly discharge of Sacandaga River at Wells, N. Y., for 1910.*  
[Drainage area, 263 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	2,070	.....	368	1.40	1.61	C
February.....	.....	.....	300	1.14	1.19	D
March.....	3,780	590	1,800	6.84	7.88	A
April.....	3,670	298	1,420	5.40	6.02	A
May.....	2,070	650	949	3.61	4.16	A
June.....	1,980	156	826	3.14	3.50	A
July.....	149	36	64.5	.245	.28	B
August.....	475	43	160	.608	.71	A
September.....	2,440	50	307	1.17	1.30	A
October.....	530	138	262	.996	1.15	A
November.....	650	161	357	1.22	1.36	A
December.....	.....	.....	120	.456	.53	D
The year.....	.....	36	575	2.19	29.68	

NOTE.— Monthly discharge 1907–1910 revised from a new discharge rating curve. These tables supersede those previously published in the New York State and Federal reports for 1907–1909, and in the sixth Annual Report of the New York State Water Supply Commission and in the 1910 report of the New York State Engineer and Surveyor.

Discharge December 15 to 31, 1907, and January 1 to February 14, 1908, estimated from study of general condition of run-off in the upper Hudson River drainage basin. Mean discharge December 15 to 31, 1907, estimated 900 second-feet; mean discharge February 1 to 14, 1908, estimated 250 second-feet.

Discharge for periods in 1910 during which ice existed determined by means of three discharge measurements made with ice present, climatological records, and comparison of the discharge with that at other stations.

Mean discharge, January 1 to 20, 1910, estimated 100 second-feet, being practically constant at about 65 second-feet January 1 to 18.

Discharge February 1 to 27, 1910, nearly constant; discharge February 28, 1910, probably a few thousand second-feet. Discharge for December, 1910, nearly constant, ranging from about 100 second-feet to nearly 300 second-feet.

*Monthly discharge of Sacandaga River at Wells, N. Y., for 1911.*  
[Drainage area, 263 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	.....	.....	240	.913	1.05	D
February.....	.....	.....	170	.646	.67	C
March.....	885	.....	248	.943	1.09	A
April.....	3,560	425	1,550	5.89	6.57	A
May.....	2,540	648	1,330	5.06	5.83	A
June.....	1,710	167	594	2.26	2.52	B
July.....	161	31	66.5	.253	.29	B
August.....	.....	16	33.1	.126	.15	B

NOTE.— Discharge during January, February and March 1 to 10 has been estimated from the discharge at Hadley.  
Mean discharge March 1 to 10, 166 second-feet.

*Sacandaga River near Hope, N. Y.*

*Location.*—Three and one-half miles above the post office at Hope, 4 miles below the village of Wells, 12 miles above Northville (the nearest railroad station), and  $1\frac{1}{2}$  miles below the junction of the east and west branches of the Sacandaga.

*Records available.*—September 15, to December 31, 1911.

*Drainage area.*—494 square miles.

*Gage.*—Staff in two sections: A sloping staff reading from 1 foot to 4.30 feet, on a slope of 2.5 to 1; a vertical staff (for high water records) attached to a rocky cliff in line with the sloping gage.

*Channel.*—Regular and permanent. Banks are fairly free from timber, high and rocky.

*Discharge measurements.*—The channel was cleared of boulders and a cable with a span of 214 feet was erected for making discharge measurements.

*Co-operation.*—Established and maintained by United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Sacandaga River near Hope, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Sept. 19....	C. S. De Golyer.....	175	338	2.04	243
Sept. 26....	C. S. De Golyer.....	175	318	1.87	197
Sept. 30....	C. S. De Golyer.....	176	382	2.34	385
Sept. 30....	C. S. De Golyer.....	176	385	2.33	378

*Daily gage height, in feet, of Sacandaga River near Hope, N. Y., for 1911.*

[Edgar Coulombe, observer.]

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1.....		2.28	3.22	3.51	17.....	2.29	2.41	3.21	4.45
2.....		2.80	3.09	3.65	18.....	2.16	3.28	4.28	4.11
3.....		2.70	3.00	3.34	19.....	2.05	4.46	3.95	3.87
4.....		3.97	2.92	3.01	20.....	1.98	4.08	3.74	3.46
5.....		3.44	2.83	2.90	21.....	1.92	3.92	3.60	3.50
6.....		3.12	2.79	3.02	22.....	1.96	3.81	3.43	3.48
7.....		3.14	3.24	2.88	23.....	1.96	4.47	3.20	5.62
8.....		3.26	4.08	2.80	24.....	1.92	4.23	3.31	4.92
9.....		3.18	3.85	2.85	25.....	1.89	3.88	3.20	4.44
10.....		3.05	3.70	3.06	26.....	1.84	3.64	3.12	4.26
11.....		2.93	3.69	3.44	27.....	1.83	3.46	3.06	4.24
12.....		2.81	3.60	4.30	28.....	1.83	3.35	2.96	4.02
13.....		2.72	4.05	5.25	29.....	2.00	3.27	3.78	3.52
14.....		2.62	3.82	4.85	30.....	2.32	3.10	3.71	3.58
15.....	2.24	2.51	3.65	4.35	31.....		3.09		
16.....	2.43	2.44	3.52	4.12					

*Sacandaga River at Northville, N. Y.*

*Location.*—About three-fourths mile upstream from the steel highway bridge at Northville, 1 mile below the mouth of East Stony Creek and 7 miles above the mouth of Vly Creek, the only important stream between the station and the mouth of the river.

*Records available.*—August 24, 1907, to November 30, 1910. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York. This station was discontinued December 1, 1910.

*Drainage area.*—740 square miles.

*Gage.*—Chain, cantilever suspension from tree on left bank; datum unchanged.

*Channel.*—Rough and fairly permanent.

*Discharge measurements.*—At high stages made from steel highway bridge in Northville, at medium and low stages made by wading a short distance above the gage.

*Artificial control.*—A low storage dam at Sacandaga Park backs water to the highway bridge but does not affect gage heights.

*Winter flow.*—Affected by ice to such an extent that gage readings are discontinued.

*Accuracy.*—Conditions for obtaining accurate discharge data during the open water periods are good and an excellent discharge rating curve has been developed.

*Co-operation.*—Station established and maintained by the United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Daily discharge, in second-feet, of Sacandaga River at Northville, N. Y., for 1910.*

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		11,200	4,390	2,450	360	400	326			
2.....		10,400	3,090	2,760	326	412	307			
3.....		7,050	3,280	2,480	326	424	412			
4.....		5,710	4,960	2,620	326	412	424			
5.....		6,800	4,720	2,760	291	370	412			
6.....		6,010	3,500	6,620	223	284	454			
7.....		7,080	2,730	5,160	226	291	424			
8.....		4,570	2,620	4,660	307	307	412			
9.....		3,700	2,170	4,210	235	370	370			
10.....		3,210	1,820	3,180	229	424	326			
11.....		2,840	1,670	3,060	223	901	291			
12.....		1,670	1,480	3,370	214	546	275			
13.....		1,530	1,300	2,620	220	424	259			
14.....		1,410	1,390	1,930	205	488	284			
15.....		1,360	1,390	1,830	191	406	291			
16.....		1,300	1,320	2,000	200	395	275			
17.....		1,410	1,070	2,170	214	370	326			
18.....		4,480	1,190	2,270	208	346	294			
19.....		6,840	1,330	2,340	200	395	253			
20.....		6,400	1,650	1,650	197	370	200			
21.....		4,450	2,340	1,300	200	360	223			
22.....		2,840	2,270	1,090	205	326	229			
23.....		2,550	2,200	829	214	259	326			
24.....	4,390	4,570	1,800	684	220	259	330			
25.....	9,750	5,960	1,930	643	226	259	297			
26.....	11,900	3,180	6,070	602	214	278				
27.....	7,440	4,660	5,750	562	220	266				
28.....	7,200	5,900	4,000	523	412	275				
29.....	11,300	4,520	2,480	436	291	259				
30.....	12,300	(4,460)	3,060	424	235	214				
31.....	14,100		2,620		223	275		1,280		

NOTE.—The discharge as published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York for March 20 to March 23 and September 26 to November 30 is in error and is not published in this report. This conclusion was reached by comparing the values in question with discharge data of the Wells, Hadley and other upper Hudson Basin Stations.

*Monthly discharge of Sacandaga River at Northville, N. Y., for 1910.*  
 [Drainage area, 740 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	.....	.....	900	1.22	1.41	D
February.....	.....	.....	750	1.01	1.05	D
March.....	14,100	.....	5,300	7.16	8.25	B
April.....	11,200	1,300	4,600	6.22	6.94	A
May.....	8,070	1,070	2,630	3.55	4.09	A
June.....	6,620	424	2,240	3.03	3.38	A
July.....	412	191	245	.331	.38	A
August.....	901	214	367	.496	.57	A
September.....	.....	200	520	.703	.78	B
October.....	.....	.....	600	.811	.94	B
November.....	.....	.....	850	1.15	1.28	B
December.....	.....	.....	350	.473	.54	D
The year.....	14,100	191	1,620	2.19	29.62	

NOTE.—Monthly discharge for periods for which no daily discharge is published is determined by a close interpolation between run-off per square mile at Wells and at Hadley.

Discharge January to March and September to November revised superseding that published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York.

#### *Sacandaga River near Hadley, N. Y.*

##### Upper bridge.

*Location.*—On steel highway bridge about 2½ miles above Hadley and 3¼ miles below Conklingville.

*Records available.*—September 13, 1907, to Dec. 31, 1910. Data also in annual reports of United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York. Station discontinued December 31, 1910.

*Drainage area.*—1050 square miles.

*Gage.*—Chain; read twice daily, datum unchanged..

*Channel.*—Rough but permanent.

*Discharge measurements.*—Made from bridge.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—Gage height at times considerably affected by back-water from log jams. Conditions fair for making discharge measurements.

*Co-operation.*—Established and maintained in co-operation with the United State Geological Survey.

##### Cable station.

*Location.*—About one-half mile west of the railroad station at Hadley, 1 mile above the confluence of Sacandaga river with the Hudson, and 4½ miles below the site of the proposed storage dam at Conklingville. No tributaries between this station and the mouth of the river. Location selected to avoid inaccuracies in the records caused by back water from log jams.

*Records available.*—September 13, 1907, to December 31, 1910, upper bridge station; September 24, 1909 to midsummer 1911, lower bridge station; Janu-



ary 1 to December 31, 1911, cable station. The cable station replaces the upper and lower bridge stations. Data also in annual reports of the United States Geological Survey.

*Drainage area.*—1,050 square miles.

*Gage.*—Recording hydrograph (Barrett-Lawrence type) 30 feet downstream from the cable, in a concrete well 3 feet square, inside dimensions. The bottom of the well is about 2 feet below low water and 12 feet below ground surface. It is connected with the river by a 4-inch cast-iron water pipe 48 feet long, its intake end pointing downstream and protected by a fine wire screen. Inside the well and securely bolted to the side is a staff gage, its zero at elevation 573.36 and referred to a United States Geological Survey aluminum tablet set in the foundation wall of the Union Bag and Paper Company's mill at Hadley. On top of the well is a concrete shelter 6 feet high and 3 feet square, inside dimensions, for protecting the recording gage. The staff gage is used only as a reference gage.

*Channel.*—Very rough but permanent. The channel at the cable was cleared of boulders as far as feasible, so that fairly accurate discharge measurements can be made at medium and high stages. Low water measurements are made at a section about three-fourths mile above the cable, where the bottom is smooth and gravelly. Measurements at this point are made from a boat or by wading.

*Winter flow.*—The water in the well and in the intake pipe never freezes over because its level is below the frost line. The relation of gage height to discharge is, however, considerably affected by ice.

*Accuracy.*—The discharge rating curve which has been developed for this station is fairly well defined.

*Co-operation.*—Station maintained in co-operation with the United States Geological Survey.

#### Lower bridge.

*Location.*—On the highway bridge a few hundred feet above the mouth of Sacandaga river.

*Records available.*—September 24, 1909, to midsummer 1911, when the station was discontinued. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—1,060 square miles.

*Gage.*—Chain; read twice daily; datum unchanged.

*Channel.*—Rough but permanent.

*Discharge measurements.*—Made from the bridge.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—Gage heights at times affected by back water from Hudson river. Conditions fairly good for making discharge measurements. See reports for 1910 for further information regarding this station. Gage heights after about July 7 are valueless, as the relation of gage height to discharge was disturbed by construction work at the bridge.

*Co-operation.*—Established in co-operation with the United States Geological Survey. Gage heights furnished through the courtesy of the Union Bag and Paper Company.

*Discharge measurements of Sacandaga River at Upper Bridge, near Hadley, N. Y., for 1910.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Dec. 30 a. . .	F. J. Shuttleworth.....	214	414	4.12	741

<sup>a</sup> Measurement made under partial ice cover.

NOTE.—Results of measurement not available at time of publication of the 1910 report.

*Daily discharge, in second-feet, of Sacandaga River at Upper Bridge near Hadley, N. Y., for 1910*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1,540	8,350	15,000	4,930	3,930	606	340	250	1,830	966	630
2.....		1,250	13,300	15,200	4,710	3,340	534	370	300	1,490	894	590
3.....		1,250	15,800	14,000	4,160	3,320	520	388	330	1,190	782	576
4.....		1,160	12,500	11,100	4,220	3,010	490	400	340	930	1,060	555
5.....		1,080	11,700	8,050	4,460	2,940	460	630	412	815	1,570	520
6.....		960	10,400	6,660	4,710	4,620	412	815	490	654	2,020	490
7.....		750	8,890	4,310	4,310	7,040	400	990	630	606	2,300	.....
8.....		750	7,840	5,760	4,220	6,770	370	715	670	590	2,120	.....
9.....		725	7,240	5,420	3,930	6,850	340	576	576	555	1,880	.....
10.....		805	7,040	5,260	3,460	6,110	340	520	508	534	1,740	.....
11.....		700	6,660	4,020	2,860	6,180	340	490	490	520	1,540	.....
12.....		605	6,110	3,460	2,760	5,940	315	715	460	508	1,410	.....
13.....		640	5,590	3,270	2,230	6,110	315	630	412	490	1,340	.....
14.....		685	5,420	3,060	2,160	5,760	290	490	448	508	1,260	.....
15.....		628	5,090	2,690	1,960	5,090	290	460	534	490	1,230	.....
16.....		628	4,770	2,230	1,920	4,020	290	448	508	460	1,150	.....
17.....		628	4,460	2,020	1,740	3,370	300	412	472	430	1,090	.....
18.....		560	4,060	3,590	1,830	3,620	340	430	448	430	966	.....
19.....		560	3,500	5,420	1,570	3,460	330	460	412	400	870	.....
20.....		599	2,690	6,180	1,710	3,370	290	490	388	400	815	.....
21.....	716	628	2,230	6,470	2,020	3,010	290	460	352	370	760	.....
22.....	3,000	805	3,060	5,940	2,230	2,460	300	400	340	388	742	.....
23.....	6,000	930	4,060	5,260	2,860	1,960	300	388	315	460	688	.....
24.....	4,020	1,440	5,260	4,620	2,940	1,660	290	352	290	508	654	.....
25.....	3,200	1,340	6,470	4,400	3,370	1,230	290	340	340	576	590	.....
26.....	2,500	1,340	7,840	4,520	5,260	930	290	315	388	606	654	.....
27.....	2,000	1,600	9,960	5,090	6,470	848	315	290	490	654	670	.....
28.....	1,800	3,310	10,800	5,940	5,690	782	340	290	1,830	715	715	.....
29.....	1,700	.....	11,700	5,940	5,830	715	370	290	2,570	1,120	688	.....
30.....	1,600	.....	12,700	5,160	4,930	670	400	270	2,340	1,260	670	.....
31.....	1,500	.....	13,600	.....	4,310	.....	352	258	.....	1,090	.....	.....

NOTE.—Daily discharge determined from a discharge rating curve not very well defined.

Daily discharge January 22 to March 4 and December 7 to 12, as published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the New York State Engineer and Surveyor, revised.

Discharge February 1 to March 3 determined from record of Lower Bridge station where there was probably only slight back-water from ice. Discharge January 22 to 31 and March 4, estimate.

## FIRST ANNUAL REPORT OF THE

Monthly discharge of Sacandaga River at Upper Bridge near Hatley, N. Y., for 1910.  
[Drainage area, 1,050 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	6,000	.....	1,120	1.07	1.23	C
February.....	3,310	560	1,020	.971	1.01	C
March.....	15,800	2,230	7,710	7.34	8.46	B
April.....	15,200	2,020	6,070	5.78	6.45	B
May.....	6,470	1,570	3,540	3.37	3.88	B
June.....	7,040	670	3,640	3.47	3.87	B
July.....	606	290	358	.341	.39	B
August.....	990	258	465	.443	.51	B
September.....	2,570	250	611	.582	.65	C
October.....	1,830	370	696	.663	.76	A
November.....	2,300	590	1,130	1.08	1.20	C
December.....	.....	.....	543	.517	.60	D
The year.....	15,800	250	2,240	2.14	29.01	

NOTE.—Discharge for periods during which ice existed have been estimated by means of five discharge measurements made with ice present, climatological records, and comparison with records of discharge at other stations. The table is a revision of and supercedes that published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York.

Discharge measurements of Sacandaga River at Cable Station near Hatley, N. Y., in 1911.

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
Jan. 18 a...	F. J. Shuttleworth.....	232	758	6.45	886
April 8....	W. G. Hoyt.....	230	1,000	5.87	4,300
April 15....	C. C. Covert.....	234	1,270	7.13	7,150
April 16....	Cullings and Clark.....	244	1,390	7.55	8,890
April 17....	E. S. Cullings.....	249	1,410	7.61	9,490
April 20....	W. G. Hoyt.....	242	1,200	6.84	6,820
June 6....	C. S. De Golyer.....	216	499	3.75	1,020
June 10....	G. H. Canfield.....	218	673	4.60	2,000
July 11 b...	G. H. Canfield.....	193	314	2.82	330
July 11 b...	G. H. Canfield.....	193	317	2.82	315
July 12 b...	G. H. Canfield.....	193	297	2.80	302
July 12 b...	G. H. Canfield.....	193	296	2.79	311
July 29....	G. H. Canfield.....	187	280	2.69	256
Sept. 3 b...	G. H. Canfield.....	193	339	2.97	389
Sept. 28 c...	W. G. Hoyt.....	104	449	2.94	323
Sept. 28 c...	G. H. Canfield.....	102	447	2.94	321
Sept. 28 c...	W. G. Hoyt.....	106	451	2.94	350
Sept. 29....	W. G. Hoyt.....	195	359	2.95	356
Oct. 10 c...	F. Weber.....	206	888	4.57	1,800
Oct. 11....	G. H. Canfield.....	206	837	4.43	1,640
Oct. 12 c...	F. Weber.....	220	604	4.29	1,450

a Measurement made at cable section; 140 feet ice cover, 92 feet open water.

b Measurements made by wading at cable section.

c Measurements made from boat one-half mile above cable.

CONSERVATION COMMISSION.

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Daily gage height, in feet, of Sacandaga River at Cable Station, Hadley, N. Y., for 1911.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.9	5.3	4.5	5.6	7.2	3.9	3.3	2.68	3.1	3.45	4.7	5.3
2.....	5.0	5.1	4.25	5.5	7.2	4.2	3.2	2.63	2.94	3.65	4.8	5.1
3.....	5.4	5.4	4.3	5.2	7.2	4.05	3.2	2.57	3.0	4.05	4.7	4.9
4.....	6.6	4.9	4.15	5.1	7.1	3.85	3.15	2.52	3.1	4.15	4.6	4.6
5.....	7.3	4.7	4.15	4.9	6.8	3.7	3.05	2.49	3.1	4.5	4.45	4.45
6.....	7.2	5.3	4.0	5.1	6.4	3.9	3.0	2.49	3.05	4.7	4.3	4.15
7.....	7.2	5.4	4.1	5.7	6.1	4.35	2.96	2.46	3.75	4.6	4.5	4.3
8.....	7.0	5.1	4.0	6.0	5.6	4.8	2.92	2.51	3.9	4.7	5.1	4.2
9.....	6.5	4.6	3.95	6.4	5.4	4.9	2.88	2.6	3.95	4.8	5.5	4.15
10.....	6.4	4.7	3.8	6.8	5.0	4.6	2.87	2.56	4.35	4.7	5.5	4.2
11.....	6.1	4.35	3.85	6.8	4.8	4.35	2.82	2.58	4.45	4.45	5.4	4.45
12.....	5.7	4.5	3.8	6.7	4.7	4.2	2.8	2.67	4.15	4.3	5.3	5.0
13.....	5.6	4.2	3.8	6.6	4.6	4.6	2.76	2.52	3.95	4.1	5.5	5.8
14.....	5.5	4.2	3.95	6.8	4.5	5.4	2.72	2.48	3.8	3.95	5.6	6.2
15.....	5.1	4.35	4.1	7.1	4.15	5.5	2.7	2.44	3.55	3.85	5.5	6.3
16.....	5.4	4.45	4.4	7.5	4.4	5.3	2.68	2.4	3.45	3.7	5.3	6.2
17.....	6.0	4.2	4.6	7.6	4.3	5.0	2.71	2.41	3.45	3.65	5.0	6.3
18.....	6.4	4.0	4.35	7.4	4.3	4.7	2.71	2.4	3.4	4.3	5.0	6.3
19.....	6.6	4.2	4.35	7.0	4.3	4.35	2.72	2.4	3.25	6.2	5.6	6.2
20.....	5.0	5.0	4.2	6.8	4.45	4.1	2.74	2.41	3.15	6.4	5.7	5.8
21.....	5.5	4.9	4.15	6.8	4.3	3.9	2.71	2.41	3.05	6.5	5.6	5.4
22.....	5.1	4.6	4.1	6.7	4.0	3.7	2.67	2.4	3.05	6.4	5.4	5.2
23.....	5.1	4.6	4.25	6.6	4.3	3.6	2.62	2.39	3.0	6.3	5.0	5.9
24.....	4.7	4.3	4.5	6.5	4.35	3.5	2.6	2.38	3.0	6.4	4.8	6.6
25.....	4.6	4.25	4.5	6.4	4.5	3.4	2.61	2.39	3.0	6.4	4.8	6.9
26.....	4.4	4.2	4.45	6.5	4.5	3.4	2.67	2.4	3.0	6.1	4.6	6.8
27.....	4.3	4.2	5.1	6.7	4.45	3.35	2.7	2.4	2.97	5.8	4.6	6.6
28.....	4.6	4.6	6.1	6.9	4.3	3.6	2.68	2.6	2.95	5.3	4.5	6.4
29.....	5.2		6.2	7.1	3.95	3.6	2.69	3.1	2.98	5.0	4.8	5.9
30.....			6.2	7.2	4.15	3.45	2.69	3.6	3.15	4.8	5.3	5.5
31.....	5.6		5.8		3.95		2.69	3.3		4.6		5.4

NOTE.—Daily gage heights for 1911 have been determined by a continuous recording automatic gage. The relation of gage height to discharge was probably affected by ice from January 1 to about March 30.

Daily discharge, in second-feet, of Sacandaga River at Cable Station, Hadley, N. Y., for 1911.

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		3,680	7,880	1,060	557	232	435	662	2,050	3,080
2.....		3,470	7,880	1,380	494	212	351	821	2,210	2,710
3.....		2,890	7,880	1,220	494	189	381	1,220	2,050	2,370
4.....		2,710	7,580	1,010	464	171	435	1,330	1,900	1,900
5.....		2,370	6,690	864	408	161	435	1,760	1,700	1,330
6.....		2,710	5,590	1,060	381	161	408	2,056	1,500	1,330
7.....		3,900	4,840	1,570	361	151	910	1,900	1,760	1,500
8.....		4,600	3,680	2,210	341	168	1,060	2,050	2,710	1,380
9.....		5,590	3,270	2,370	322	200	1,110	2,210	3,470	1,330
10.....	700	6,690	2,540	1,900	317	186	1,570	2,050	3,470	1,380
11.....	650	6,690	2,210	1,570	293	193	1,700	1,700	3,270	1,700
12.....	650	6,400	2,050	1,380	284	228	1,330	1,500	3,080	2,540
13.....	650	6,120	1,900	1,900	266	171	1,110	1,270	3,470	4,130
14.....	750	6,690	1,760	3,270	249	157	956	1,110	3,680	5,080
15.....	750	7,580	1,330	3,470	240	144	738	1,010	3,470	5,330
16.....	800	8,780	1,630	3,080	232	131	662	864	3,080	5,080
17.....	850	9,080	1,500	2,540	244	134	662	821	2,540	5,330
18.....	878	8,480	1,500	2,050	244	131	625	1,500	2,540	5,330
19.....	850	7,280	1,500	1,570	249	131	526	5,080	3,680	5,080
20.....	900	6,690	1,700	1,270	258	134	464	5,590	3,900	4,130
21.....	1,000	6,690	1,500	1,060	244	134	408	8,550	3,680	3,270
22.....	930	6,400	1,160	864	228	131	408	5,590	3,270	2,890
23.....	1,000	6,120	1,500	778	208	128	381	5,330	2,540	4,360
24.....	1,080	5,850	1,570	698	200	125	381	5,590	2,210	6,120
25.....	1,080	5,590	1,760	625	204	128	381	5,590	2,210	6,980
26.....	1,360	5,850	1,760	625	228	131	381	4,840	1,900	6,690
27.....	1,650	6,400	1,700	591	240	131	366	4,130	1,900	6,120
28.....	3,310	6,980	1,500	778	232	200	356	3,080	1,760	5,590
29.....	3,830	7,580	1,110	778	236	435	371	2,540	2,210	4,360
30.....	4,210	7,880	1,330	662	236	778	464	2,210	3,080	3,470
31.....	4,130		1,110		236	557		1,900		3,270

NOTE.—Daily discharge determined from a fairly well-defined discharge rating curve. The discharge March 10 to 14, 18 and 21 to 30 taken from the record at the lower station, where there was probably no back-water from ice.

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Monthly discharge of Sacandaga River at Cable Station, Hadley, N. Y., for 1911.  
[Drainage area, 1,050 square miles.]

MONTH	MAXIMUM.				Minimum.	Mean.	Per square mile.	Run-off depth in inches.	Accuracy.
	Day.	Hour.	Gage height.	Discharge.					
			<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>		
January.....	5	4 P. M.	7.48	.....	.....	1,030	.981	1.13	C
February.....	1	10 A. M.	5.71	.....	.....	735	.700	.73	B
March.....	30	8 A. M.	6.31	.....	.....	1,250	1.19	1.37	B
April.....	17	8 A. M.	7.60	9,080	2,370	5,920	5.64	6.29	A
May.....	1	2 A. M.	7.25	8,030	1,110	2,930	2.79	3.22	A
June.....	15	2 P. M.	5.52	3,510	591	1,470	1.40	1.56	B
July.....	1	1 A. M.	3.36	598	200	296	.282	.33	B
August.....	30	12 N.	3.69	855	125	202	.192	.22	B
September.....	10	12 N.	4.52	1,790	351	659	.628	.70	B
October.....	20	12 M.	6.50	5,850	662	2,680	2.55	2.94	A
November.....	20	12 N.	5.73	3,970	1,500	2,680	2.55	2.84	A
December.....	25	10 A. M.	6.91	7,010	1,330	3,710	3.54	4.08	A
The year.....	April 17	8 A. M.	7.60	9,080	.....	1,970	1.88	25.41	

NOTE.— Discharge January 1 to March 9 estimated by means of 4 discharge measurements made at the cable and lower bridge stations with ice present, the discharge at Corinth, and climatological records.

Mean discharge March 1 to 9, 733 second-feet.

Maximum discharge determined from the crest gage heights of the various months. Determinations of maximum discharge for January and February omitted because of back-water from ice. For maximum discharge for the corresponding 24-hour period, see table of daily discharge.

M. = Midnight, N = Noon.

Discharge measurements of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1911.

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Jan. 31a.....	C. C. Covert.....	128	834	7.82	761
Feb. 10b.....	C. C. Covert.....	118	735	7.48	736
Feb. 27c.....	C. C. Covert.....	116	566	5.96	773
Mar. 18d.....	C. S. De Golyer.....	109	581	5.93	878

a Ice below bridge causing backwater.

b Ice below bridge causing backwater and some slush ice for about 40 feet along left hand abutment.

c 55 feet of ice out from left hand abutment, rest of channel open; thickness of ice, 1.0 feet.

d River free from ice at bridge; About 200 feet below bridge it extends nearly across the river.

Daily gage height, in feet, of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1909.

[Union Bag and Paper Company, observers.]

DAY.	Sep.	Oct.	Nov.	Dec.	DAY.	Sep.	Oct.	Nov.	Dec.
1.....	.....	4.50	4.40	5.20	17.....	.....	4.15	4.40	4.90
2.....	.....	4.30	4.40	5.10	18.....	.....	4.20	4.45	5.05
3.....	.....	4.35	4.50	5.25	19.....	.....	4.30	4.65	5.05
4.....	.....	4.25	4.40	5.20	20.....	.....	4.40	4.50	5.25
5.....	.....	4.25	4.40	5.00	21.....	.....	4.40	4.40	5.50
6.....	.....	4.20	4.40	4.90	22.....	.....	4.50	4.50	5.50
7.....	.....	4.10	.....	4.80	23.....	.....	4.60	4.50	5.50
8.....	.....	4.05	4.40	4.80	24.....	4.00	4.80	4.70	5.40
9.....	.....	4.05	4.30	4.80	25.....	4.00	4.80	5.05	.....
10.....	.....	4.10	4.40	4.90	26.....	4.00	4.80	5.20	.....
11.....	.....	4.05	4.40	4.80	27.....	4.05	4.80	5.30	5.40
12.....	.....	4.00	4.40	5.10	28.....	4.10	4.70	5.15	5.50
13.....	.....	3.90	4.40	5.00	29.....	4.50	4.70	5.20	5.40
14.....	.....	3.92	.....	5.25	30.....	4.40	4.50	5.40	5.40
15.....	.....	4.05	4.40	5.10	31.....	.....	4.50	.....	5.40
16.....	.....	4.10	4.40	5.00					

NOTE.— Daily gage height affected by ice December 10-31.

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Daily gage height, in feet, of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1910.  
[Union Bag and Paper Co., observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		6.5	10.0	13.8		8.8	4.65	4.40	4.30	6.9	5.8	5.20
2.		6.2	11.5	14.0	8.7	8.6	4.55	4.30	4.31	6.1	5.6	5.20
3.		6.2	12.2	12.5	8.4	8.2		4.30	4.35	5.7	5.50	5.05
4.		6.1	12.2	11.6	8.4			4.40		5.50	5.7	
5.		6.0	15.9	11.4	8.8		4.70	4.90		5.40	6.2	4.90
6.				10.7	8.8	8.4	4.55	5.80	5.10	5.30		4.85
7.		5.50	11.2	10.5	8.6	8.4	4.35		5.30	5.30	7.1	5.00
8.		5.50	10.8	10.3		10.0	4.25	4.70	5.40	5.20	6.8	5.35
9.		5.45	10.5	10.0	8.0	10.0	4.40	4.70	5.25		6.6	5.6
10.		5.6	10.5		7.6	9.6		4.60	5.15	5.10	6.3	6.3
11.		5.40	10.2	9.0	7.4	9.2	4.35	4.70	4.80	5.10	6.2	
12.		5.20	9.4	8.6	7.2		4.30	5.30	4.80	5.00	6.2	6.8
13.			9.1	8.1	7.0	9.0	4.25	4.90	4.75	5.00		7.5
14.		5.35	8.8	7.6	6.8	8.8	4.30		5.15	4.90	6.0	7.0
15.		5.25	8.8	7.4		8.4	4.30	4.80	5.10	4.90	6.0	6.9
16.		5.25	8.5	7.0		8.2	4.20	4.70	5.00		5.8	7.4
17.		5.25	8.0		6.6	7.8		4.60	4.80	4.90	5.8	7.4
18.		5.10	7.5	7.0	6.4	7.7	4.30	4.75	4.70	4.80	5.50	
19.		5.10	7.8	8.9	6.8		4.30	4.80	4.60	4.75	5.35	7.0
20.				9.6	7.0	7.8	4.05	4.80	4.50	4.70		6.8
21.		5.25	7.8	9.4	6.9	7.3	4.05		4.50	4.70	5.20	6.6
22.		5.6	8.2	9.4		6.9	4.20	4.75	4.50	4.70	5.20	6.6
23.		5.8	8.6	9.1	7.4	6.6	4.25	4.60	4.50		5.30	
24.	8.2	6.4	9.0		7.3	6.3		4.55	4.45	5.10	5.30	
25.	8.2	6.3		9.8	8.3	8.2	4.40	4.50		5.00	5.30	
26.	8.1	6.3	11.0	8.6	9.3		4.40	4.55	5.00	5.20	5.25	
27.	7.7		12.0	9.4	10.0	5.6	4.40	4.40	6.2	5.30		
28.	7.4	7.8	12.0	9.7	9.8	5.35	4.40		6.9	5.7	5.20	
29.	7.2		11.8	9.4		5.15	4.55	4.35	8.2	6.3	5.20	
30.	7.0		12.2	9.2		8.9	4.95	4.60	4.30	7.6	5.30	
31.	6.6		13.0		8.8		4.50	4.30		6.0		

NOTE.—Back-water from ice about January 25 to 31, and about December 7 to 31; also slight back-water during the first few and last few days of February.

Daily gage height, in feet, of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1911.  
[Union Bag and Paper Co., observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.
1.		8.0	6.3	8.2	10.8	6.0	5.0	4.5
2.		7.9	6.0	7.7	11.0	6.4		4.45
3.		8.6	6.0	7.5	11.1	6.2	4.95	4.4
4.			8.0	5.9		10.8		4.35
5.	10.1			7.4	10.2	5.6	4.75	4.3
6.	9.8	8.2		7.5	9.6	5.8	4.7	
7.	9.2	8.2	5.6	8.2		6.4	4.6	4.25
8.		8.0	5.7	8.7	8.4	7.3	4.6	4.25
9.	8.2	7.2	5.6		8.1	7.6		
10.	8.1	7.4	5.4	8.7	7.7	7.1	4.6	
11.	7.6	6.9	5.3	9.9	7.4		4.5	
12.	7.4			9.8	7.2	6.4	4.5	
13.	7.4	6.4	5.3	10.0	7.2	6.9	4.5	
14.	7.3	6.4	5.5	10.2		7.8	4.45	4.25
15.		6.6		10.6	6.4	8.0	4.4	4.15
16.	7.9	6.9			6.8	7.8		4.15
17.	8.6	6.8		11.2	6.6	7.6	4.4	4.15
18.	9.4	6.1		11.2	6.6		4.35	4.15
19.	9.7			10.7	6.2	6.7	4.4	4.15
20.	9.5	6.9		10.4	6.8	6.4	4.5	
21.	8.3	7.2	5.9	10.1		6.0	4.5	4.1
22.		6.6	5.8	10.1	6.1	5.7	4.45	4.1
23.	7.7	6.3	5.9		6.6	5.5		4.0
24.	6.8	6.1	6.0	10.0	6.65	5.3	4.4	
25.	6.6	5.8	6.0	9.8	6.9		4.4	4.0
26.	6.2			10.1	6.9	5.3	4.5	4.1
27.	6.2	5.9	6.6	10.2	6.6	5.1	4.5	
28.	6.1	6.3	7.8	10.6		5.5	4.45	4.2
29.			8.1	10.7	6.0	5.6	4.45	4.9
30.		6.5	8.3			5.4		5.9
31.		7.8	8.5		6.0		4.5	5.4

NOTE.—Relation of gage height to discharge probably affected by back-water from ice and log jams from about January 1, to about March 9, and by back-water from the Hudson from about April 11, to about May 14; known to be affected July 8, to August 31, by construction work on the bridge which necessitated the movement of the chain gage.

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*Daily discharge, in second-feet, of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1909.*

DAY.	Sept.	Oct.	Nov.	Dec.	DAY.	Sept.	Oct.	Nov.	Dec.
1		350	325	605	17		265	325	
2		300	325	560	18		275	338	
3		312	350	628	19		300	395	
4		312	325	605	20		325	350	
5		288	325	520	21		325	325	
6		275	325	480	22		350	350	
7		255	(325)	445	23		380	350	
8		245	325	445	24	235	445	410	
9		245	300	445	25	235	445	540	
10		255	325		26	235	445	605	
11		245	325		27	245	445	650	
12		235	325		28	255	410	582	
13		215	325		29	350	410	605	
14		217	(325)		30	325	350	700	
15		245	325		31		350		
16		255	325						

*Daily discharge, in second-feet, of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1910.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1,540	8,350				395	325	300	2,000	930	605
2		1,250	13,300				365	300	300	1,160	805	605
3		1,250	15,800				380	300	313	865	750	540
4		1,160					395	325	390	750	865	(510)
5		1,080					410	480	470	700	1,250	480
6		960					365	930	560	650	1,760	462
7		750					313	670	650	650	2,260	
8		750					288	410	700	605	1,880	
9		725			3,650		325	410	628	582	1,650	
10		805			2,990		319	380	580	560	1,340	
11		700			2,690	6,100	313	410	445	560	1,250	
12		615			2,400	5,900	300	650	445	520	1,250	
13		640			2,130	5,700	288	480	428	520	1,170	
14		685	5,250	2,990	1,880	5,250	300	462	582	480	1,080	
15		628	5,250	2,690	1,880	4,410	300	445	560	480	1,080	
16		628	4,610	2,130	1,880	4,020	275	410	520	480	930	
17		628	3,650	2,130	1,650	3,310	288	380	445	480	930	
18		560	2,840	2,130	1,440	3,150	300	428	410	445	750	
19		560	3,310	5,470	1,880	3,230	300	445	380	428	675	
20		599			2,130	3,310	245	445	350	410	640	
21		628			2,000	2,540	245	436	350	410	605	
22		805			2,390	2,000	275	428	350	410	605	
23		930			2,690	1,650	288	380	350	485	650	
24	4,020	1,440			2,540	1,340	306	365	338	560	650	
25	3,200	1,340		4,210	4,020	930	325	350	430	520	650	
26	2,500	1,340				860	325	365	520	605	628	
27	2,000	1,500				805	325	325	1,250	650	616	
28	1,800	3,310				675	325	319	2,000	865	605	
29	1,700					582	365	313	4,020	1,340	605	
30	1,600					500	380	300	2,990	(1,210)	650	
31	1,500						350	300		1,080		

NOTE.—Daily discharge for 1909 to 1910 determined from a discharge rating curve not very well defined. Discharge for days omitted from the record during periods September 24 to December 31, 1909, and January 24 to December 22, 1910, was affected by back-water from ice, log jams, or high stages in the Hudson. Discharge January 23 to 31, estimated; no correction made to February; discharge for possible back-water from ice.

*Daily discharge, in second-feet, of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1911.*

DAY.	Mar.	April.	May.	June.	July.	DAY.	Mar.	April.	May.	June.	July.
1.....		4,020		1,080	520	17.....	840		1,650	2,990	
2.....		3,150		1,440	510	18.....	880		1,650	2,380	
3.....		2,840		1,250	500	19.....	920		1,250	1,760	
4.....		2,760		1,030	464	20.....	960		1,880	1,440	
5.....		2,690		805	428	21.....	1,000		1,520	1,080	
6.....		2,840		930	410	22.....	930		1,160	865	
7.....		4,020		1,440	380	23.....	1,000		1,650	760	
8.....		5,030		2,540		24.....	1,080		1,700	650	
9.....		5,030		2,990		25.....	1,080		2,000	650	
10.....	700	5,030		2,260		26.....	1,360		2,000	650	
11.....	650			1,850		27.....	1,650		1,650	560	
12.....	650			1,440		28.....	3,310		1,360	750	
13.....	650			2,000		29.....	3,830		1,080	805	
14.....	750			3,310		30.....	4,210		1,080	700	
15.....	780		1,440	3,650		31.....	4,610		1,080		
16.....	810		1,880	3,310							

*NOTE.*—Daily discharge determined from a discharge rating curve not very well defined. Discharge for days omitted from the record during periods January 1 to March 9, and April 11 to May 14, affected by back-water from ice, log jams, or high stages in the Hudson. The record omitted July 8 to August 31, was affected by change in the gage necessitated by construction work at the bridge. Mean discharge for June, when there was probably no back-water was 1,580 second-feet. Discharge interpolated for days on which the gage was not read.

*Monthly discharge of Sacandaga River at Lower Bridge at Hadley, N. Y., for 1909, 1910 and 1911.*  
[Drainage area, 1,060 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				Run-off depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1909.						
October.....	445	215	315	.297	.34	B
November.....	700	300	391	.369	.41	B
1910.						
February.....	3,310	560	1,020	.962	1.00	C
July.....	410	245	322	.304	.35	B
August.....	930	300	418	.394	.45	B
September.....	4,020	300	735	.693	.77	C
October.....	2,000	410	692	.653	.75	A
November.....	2,260	605	984	.928	1.04	C
1911.						
June.....	2,990	560	1,580	1.49	1.66	B

*West Branch Sacandaga at Blackbridge, N. Y.*

*Location.*—On the highway bridge known as Blackbridge, about 3 miles west of Wells and 2 miles above the junction of East and West branches of Sacandaga river. Replaces station formerly located at Whitehouse.

*Records available.*—March 14, to December 31, 1911. Data also in annual reports of United States Geological Survey.

*Drainage area.*—211 square miles.

*Gage.*—Chain, attached to upstream side of the highway bridge; read twice daily; datum unchanged.

*Channel.*—Rocky and permanent; two channels at extreme high water.

*Discharge measurements.*—Made from the bridge and by wading. Section beneath the bridge was cleared of boulders in September, 1911.



**Artificial control.**—Gage heights slightly affected by storage dams used for logging in the spring.

**Winter flow.**—Probably little affected by ice. Stream open during greater part of the winter.

**Co-operation.**—Established by the United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of West Branch of Sacandaga River at Black Bridge near Wells, N. Y., in 1911*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 23.....	C. S. De Golyer.....	87	66	3.10	75
Sept. 29.....	C. S. De Golyer.....	70	118	3.65	185
Sept. 29.....	C. S. De Golyer.....	70	119	3.65	176
Sept. 30.....	C. S. De Golyer.....	71	132	3.80	218

Measurements made by wading under upstream side of bridge.

a Gage heights uncertain as gage was slightly disturbed and had not been reset by level.

*Daily gage height, in feet, of West Branch of Sacandaga River at Black Bridge, near Wells, N. Y. for 1911.*

[Cornelius De Groff, observer.]

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		4.85	6.62	4.40	3.72	2.94	3.53	3.70	4.35	4.76
2.....		4.68	7.51	4.08	3.70	2.90	3.26	3.80	4.45	4.66
3.....		4.56	6.26	4.04	3.66	2.85	3.47	3.90	4.40	4.45
4.....		4.58	6.19	3.80	3.58	2.89	3.32	4.40	4.25	4.35
5.....		4.62	6.14	4.32	3.55	2.84	3.20	4.65	4.35	4.35
6.....		4.84	5.57	4.06	3.51	3.75	3.88	4.50	4.15	4.25
7.....		5.68	5.06	4.52	3.50	3.42	3.96	4.30	4.55	4.10
8.....		5.67	5.25	4.34	3.51	3.06	4.15	3.11	5.20	4.10
9.....		5.33	4.47	4.06	3.48	3.31	4.31	4.51	5.15	4.20
10.....		5.23	1.55	4.10	3.44	3.16	4.32	4.55	5.15	4.51
11.....		5.12	4.15	3.99	3.40	2.99	4.24	4.45	5.05	4.75
12.....		5.28	4.20	3.86	3.38	2.96	4.02	4.25	5.10	5.80
13.....		5.52	4.55	4.70	3.36	3.83	3.92	4.10	5.25	6.45
14.....	3.84	5.98	4.85	5.46	3.32	3.78	3.84	3.15	5.15	5.55
15.....	4.92	6.10	4.40	4.86	3.27	3.64	3.91	4.46	6.50	5.80
16.....	5.30	6.14	4.40	4.86	3.42	3.48	3.78	3.80	4.55	5.56
17.....	5.40	6.04	5.65	4.54	3.46	3.35	3.66	3.75	6.20	6.60
18.....	4.67	5.90	4.65	4.42	3.40	2.95	3.50	4.50	5.10	5.65
19.....	4.58	5.90	4.80	4.24	3.23	2.86	a	4.25	5.40	5.25
20.....	4.46	5.85	5.20	4.03	3.18	2.99	a	5.20	5.15	5.20
21.....	4.14	6.00	4.76	3.84	3.08	2.94	a	5.20	5.05	4.95
22.....	3.97	5.90	4.80	3.82	2.95	2.88	a	1.35	4.55	4.76
23.....	4.24	5.85	5.20	3.74	3.08	2.82	3.14	5.70	4.35	6.80
24.....	4.13	5.82	5.02	3.64	3.26	2.78	3.08	5.40	4.70	5.60
25.....	4.08	5.74	5.05	3.62	3.40	2.74	3.10	4.35	4.55	5.45
26.....	3.96	6.41	5.00	3.57	3.22	2.82	3.10	5.10	4.25	5.51
27.....	4.76	6.68	4.28	3.61	3.14	2.90	3.10	5.05	4.25	5.65
28.....	5.74	7.45	4.12	3.73	3.08	3.14	3.10	4.65	4.25	4.65
29.....	5.42	7.40	4.12	3.60	3.02	4.15	3.58	4.50	4.65	4.95
30.....	4.90	7.10	4.08	3.68	2.96	3.88	3.80	4.30	4.81	4.76
31.....	5.04		4.15		2.98	3.66		3.90		4.96

a Record missing; gage injured by blasting in river channel, readings for remainder of year may be slightly in error.

*Miscellaneous discharge measurements in Hudson River drainage basin in 1911.*

DATE.	Stream.	Tributary to —	Locality.	Gage height.	Discharge.
				<i>Feet.</i>	<i>Sec.-ft.</i>
Nov. 17.....	Big Brook.....	Indian River.....	Highway bridge over mouth of stream near Indian Lake, N. Y.	a10.2	162
July 22.....	East Stony Creek..	Sacandaga river near Northville..	300 yds. above highway bridge on road to Wells..	c1.90	8.9
July 24.....	West Stony Creek..	Sacandaga river near Northville..	Above highway bridge on road to Benson Centre	d2.56	10.9

<sup>a</sup> Distance to water surface below top of right hand upstream abutment.

<sup>c</sup> Distance to water surface from upstream corner of concrete footing course under left hand abutment.

<sup>d</sup> Distance to water surface from top of notched stone in footing course upstream side of left hand abutment.

CATTARAUGUS CREEK DRAINAGE BASIN.

*Description.*

Cattaraugus creek rises in the southwestern part of Wyoming county and flows in a westerly direction, entering Lake Erie about 25 miles southwest of Buffalo, on the boundary line between Erie and Chautauqua counties. The stream is about 55 miles in length and drains an area of approximately 560 square miles above the mouth. A large portion of its course forms the boundary between Erie and Chautauqua counties. Its head waters rise at an elevation of between 1,900 to 2,000 feet. The drainage basin is hilly, fairly well timbered and rather narrow. There are few tributary streams, those of most importance entering the river from the south.

South branch of Cattaraugus creek, which is the largest tributary, enters at a point about 2 miles above Gowanda. There is a dam at Gowanda which is used for developing electric power and also for running a local grist mill and foundry. Formerly there was a development at Versailles, but a flood a few years ago washed the dam out and at present the developments at Gowanda are practically the only ones on the stream.

The average rain fall on the drainage basin is approximately 40 inches. A gaging station was established on this stream at Versailles, September 23, 1910.

*Cattaraugus Creek at Versailles, N. Y.*

*Location.*— On a 3-span highway bridge in the village of Versailles, about 6 miles below Gowanda,  $2\frac{1}{4}$  miles above the mouth of Clear creek (coming in from the right), and about 8 miles above the mouth of the stream.

*Records available.*— September 23, 1910, to December 31, 1911. Data published also in annual reports of the United States Geological Survey and New York State Engineer and Surveyor.

*Drainage area.*— 467 square miles.

*Gage.*— Chain, fastened to the upstream side of the first span from the right hand end of the bridge; read twice daily; datum unchanged.

*Channel.*—Rock and gravel; considered permanent.

*Discharge measurements.*—Made from downstream side of the bridge.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—Discharge curve not sufficiently developed to warrant the publication of daily discharge.

*Co-operation.*—Station established and maintained by United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Cattaraugus Creek, at Versailles, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 13 a.....	F. J. Shuttleworth.....	94	210	5.55	542
April 18.....	C. S. De Golyer.....	159	340	5.90	928

a Ice along shore may have effected gage height.

*Daily gage height, in feet, of Cattaraugus Creek at Versailles, N. Y., for 1911.*

[James A. Palmer, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.6	6.0	6.0	5.85	6.85	5.3	5.18	5.00	5.65	6.0	5.80	6.5
2.....	8.4	5.98	5.85	5.85	6.5	5.23	5.08	5.00	5.55	6.75	5.72	6.25
3.....	7.6	5.78	5.70	5.78	6.0	5.3	5.00	5.05	5.45	6.0	5.60	6.15
4.....	6.6	6.1	5.58	5.9	5.78	5.22	5.00	6.05	5.32	6.35	5.52	5.90
5.....	6.3	5.75	5.45	8.1	5.65	5.3	5.00	5.70	5.32	6.4	5.50	5.82
6.....	5.98	5.55	5.55	7.7	5.55	6.3	5.00	5.58	7.05	6.15	5.52	5.80
7.....	6.0	5.50	5.35	8.0	5.52	5.22	5.22	5.25	7.2	5.95	6.0	5.82
8.....	6.0	5.68	5.55	6.6	5.48	5.2	5.08	5.72	7.7	5.88	6.5	5.98
9.....	6.3	5.75	5.02	6.4	5.42	5.22	5.05	5.35	6.15	5.85	5.90	6.25
10.....	8.4	5.65	6.8	6.3	5.42	5.2	5.10	5.30	5.78	5.75	5.68	6.65
11.....	8.4	5.50	6.3	6.2	5.48	5.2	5.12	5.15	5.70	5.70	5.70	6.5
12.....	7.7	5.50	7.4	6.15	5.22	5.2	5.08	5.10	5.62	5.72	5.85	6.55
13.....	7.2	5.50	6.5	5.95	5.00	5.2	5.00	5.10	5.65	5.62	6.1	7.96
14.....	7.1	5.65	6.8	6.0	5.42	5.2	5.00	5.10	5.60	5.52	6.1	7.0
15.....	7.35	6.25	6.9	6.15	5.38	5.18	4.95	5.05	5.60	5.52	6.15	7.1
16.....	6.85	6.1	6.5	5.95	5.38	5.12	4.95	5.55	5.60	5.55	6.1	6.75
17.....	6.05	8.0	6.3	5.98	5.32	5.1	5.00	5.35	5.40	5.52	6.0	6.65
18.....	5.88	7.8	6.0	5.45	5.35	5.1	5.30	5.25	5.42	5.62	8.4	6.45
19.....	5.92	7.0	5.8	5.80	5.68	5.1	5.08	5.15	5.40	5.60	6.7	6.1
20.....	5.92	6.4	5.92	6.0	6.1	5.1	5.30	5.05	5.40	5.90	6.5	5.85
21.....	6.1	6.3	6.0	5.98	5.4	5.05	5.22	5.00	5.32	5.52	6.4	5.88
22.....	6.1	5.98	6.55	6.0	5.32	5.0	5.18	5.10	5.32	5.42	6.25	5.98
23.....	6.0	5.78	6.8	5.85	5.3	5.15	5.18	5.12	5.32	5.62	6.2	6.9
24.....	5.6	5.80	6.0	5.82	5.32	5.15	5.10	5.12	5.22	5.65	6.75	6.2
25.....	5.70	5.82	5.82	6.68	5.35	5.1	5.10	5.30	5.48	5.90	6.45	6.05
26.....	5.75	6.15	6.3	5.62	5.32	5.12	5.15	5.35	5.38	5.62	6.25	6.0
27.....	6.2	6.7	7.55	5.55	5.22	5.38	5.10	5.45	5.30	5.58	6.1	6.4
28.....	7.9	6.1	7.15	5.55	5.28	5.65	5.10	6.85	5.32	5.90	6.1	5.92
29.....	6.65	.....	6.4	5.50	5.25	5.45	5.12	7.5	5.30	5.48	7.05	6.45
30.....	6.25	.....	6.3	5.62	5.22	5.22	5.10	6.2	5.38	5.40	6.7	6.05
31.....	6.0	.....	6.1	.....	5.22	.....	5.00	5.75	.....	5.48	.....	6.0

NOTE.—Some uncertainty exists regarding the extent of back-water from ice at this station. Ice jams were frequent during January, and probably the relation of gage height to discharge was more or less affected by ice during the greater portion of February and March.

## GENESEE RIVER DRAINAGE BASIN.

*Description.*

Genesee river rises in Potter county, Pa., 8 or 10 miles south of the New York-Pennsylvania boundary, flows northwestward for about 32 miles by general course, then turns to the northeast, and empties into Lake Ontario, 7 miles north of Rochester. The entire length of the stream, following bends, is about 135 miles, and the drainage area is about 2,450 square miles.

In the 39 miles between Belmont, in central Allegheny county, and Portage, in southwestern Livingston county, the fall of the water-surface is 253 feet, an average of 6.4 feet per mile. At Portage the river plunges down in three magnificent falls, and thence nearly to Mount Morris flows at the bottom of a deep gorge. From Mount Morris to Rochester the valley is broad and open and the stream is bordered by meadows subject to occasional overflow. At Rochester there is another abrupt descent over three heavy falls, amounting to about 260 feet within the city.

In the northern counties the surface is rolling, with long, easy slopes, except along the streams, which usually lie in deep ravines, hemmed in by steep banks. On the whole there is a gradual rise away from the lakes, and in the upper half of the basin the country becomes rough and is broken by ridges, the summits of which attain elevations of from 2,000 to 2,500 feet above tide.

Precipitation is rather low, the average rainfall being about 35 inches, some 14 inches smaller than that of the upper Sacandaga. Possibilities for storage are great and the State of New York Conservation Commission proposes a high concrete dam, in the vicinity of Portage, which will store about 19,000,000,000 cubic feet of water, 13,400,000,000 cubic feet of which will be available for commercial purposes. This dam would have a water surface of about  $13\frac{1}{2}$  square miles. Such a reservoir would control a flow equal to the greatest recorded, that of 1865. In addition to this high degree of river control the reservoir could be used to develop electric horsepower at Portage to the extent of 75,000 horsepower, peak load, and at the same time allow the mills at Rochester to run the entire year.

*Genesee River at St. Helena, N. Y.*

*Location.*—At the steel highway bridge about 6 miles above the mouth of Silver Lake outlet (coming in from the left),  $9\frac{1}{2}$  miles above Canaseraga creek (coming in from the right), and  $5\frac{1}{2}$  miles below the village of Portageville and the site of the proposed storage dam of the State of New York Conservation Commission of New York.

*Records available.*—August 14, 1908, to December 31, 1911. Published also in annual reports of the State Water Supply Commission of New York, 1910, report of the New York State Engineer and Surveyor and the United States Geological Survey.

*Drainage area.*—1,030 square miles.

*Gage.*—Chain, fastened to the upstream side of the bridge, middle span; read twice daily. Datum unchanged since established. Since August 24, 1911 a Gurley self-recording gage with intake pipe to a well a few feet downstream from the chain gage. Datum same as chain gage, but readings different, due to slope of water surface.

*Channel.*—Gravel and rocks; considered permanent.

*Discharge measurements.*—A high stages made from the bridge, at low and medium stages either by wading or from the bridge.

*Winter flow.*—Relation between gage height and discharge, usually but slightly affected by ice; determination of winter discharge considered good.

*Accuracy.*—Discharge rating curve well defined, and data as published considered excellent.

*Co-operation.*—Established and maintained by the United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Genesee River at St. Helena, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft</i>
Feb. 27 a.....	C. C. Covert.....	224	449	3.56	1,180
Aug. 16.....	C. S. De Golyer.....	153	260	2.60	530
Aug. 19.....	W. G. Hoyt.....	95	171	2.06	207
Aug. 22.....	C. S. De Golyer.....	80.5	119	1.46	51.2
Aug. 23 b.....	W. G. Hoyt.....	92	76.2	1.45	53.3
Sept. 20.....	W. G. Hoyt.....	119	223	c 2.30	350

a Ice reduced discharge about 10 per cent.

b Measurement made by wading above bridge.

c Automatic gage height 2.26 feet.

*Daily gage height in feet (Chain gage) of Genesee River at St. Helena, N. Y., for 1911.*

[Herman Piper, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.
1.....	4.50	3.50	3.80	3.75	3.30	2.80	2.11	1.71
2.....	5.20	3.45	3.70	3.15	4.40	2.46	1.95	1.74
3.....	7.20	3.30	3.40	3.50	3.80	2.55	1.98	1.72
4.....	5.20	3.30	3.10	3.60	3.50	2.28	1.96	1.86
5.....	4.30	3.10	2.78	5.40	3.25	2.39	1.76	2.60
6.....	3.65	2.80	3.05	6.40	3.10	2.34	1.88	2.06
7.....	3.70	2.48	3.10	7.40	3.00	3.10	1.84	2.70
8.....	3.70	2.70	2.80	5.60	3.40	2.65	1.85	2.06
9.....	3.70	3.05	2.90	4.90	2.75	2.49	1.58	1.96
10.....	3.35	3.00	4.00	5.20	2.70	2.39	1.61	1.80
11.....	3.60	2.80	5.10	4.70	2.75	2.28	1.76	1.70
12.....	6.00	2.70	6.00	4.40	2.70	2.36	1.51	1.75
13.....	5.20	2.80	6.10	4.00	2.70	5.60	1.80	1.58
14.....	6.40	2.70	5.70	4.00	2.50	4.20	1.80	1.82
15.....	6.60	2.70	5.60	4.60	2.44	3.35	1.68	1.50
16.....	4.80	3.05	4.20	4.10	2.45	3.05	1.60	2.42
17.....	4.20	3.00	4.00	4.10	2.50	2.80	1.82	2.18
18.....	3.80	6.80	3.90	3.90	2.55	2.60	1.94	2.05
19.....	3.80	5.60	3.30	3.75	2.80	2.55	1.96	2.06
20.....	3.60	4.60	3.50	4.70	2.70	2.41	2.02	1.72
21.....	3.50	4.00	3.35	4.70	2.70	2.31	2.01	1.95
22.....	3.65	3.70	4.50	4.60	2.60	2.21	1.91	1.72
23.....	3.20	4.90	5.70	4.40	2.49	2.29	1.86	1.70
24.....	2.58	4.80	4.40	4.20	3.36	2.26	1.89	1.68
25.....	2.95	3.80	3.75	3.80	2.95	2.18	2.06	.....
26.....	2.90	3.70	4.30	3.60	2.55	2.18	1.82	.....
27.....	3.35	4.90	7.00	3.40	2.42	2.28	1.70	.....
28.....	7.10	4.60	6.70	3.25	2.41	2.40	1.65	.....
29.....	5.20	.....	4.80	3.10	2.22	2.28	1.91	.....
30.....	6.10	.....	4.30	3.06	2.08	2.18	1.51	.....
31.....	4.00	.....	4.00	.....	2.26	.....	1.74	.....

NOTE.—Gage heights January 1 to August 24 referred to chain gage.

Effect of backwater from ice somewhat uncertain from January to March, but the relation of gage height to discharge was probably little affected by ice except January 7 to 11, 19 to 27, February 23 to 26 and March 6 to 7. Gage readings were to water surface. Probably no backwater from ice during December.

Daily gage heights, in feet, by Automatic and Chain gages, of Genesee River at St. Helena, N. Y.  
for August 25 to December 28, 1911.

DAY.	AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1.			2.75	2.80	2.68	2.79	2.97	3.10	3.44	3.65
2.			2.59	2.60	4.14	4.50	2.94	3.02	3.28	3.35
3.			2.46	2.55	3.69	3.65	2.75	2.81	3.17	3.28
4.			2.35	2.30	3.40	3.49	2.64	2.68	2.96	2.96
5.			2.21	2.25	4.03	4.02	2.57	2.61	3.00	3.09
6.			3.87	4.70	3.34	3.28	2.53	2.59	2.96	2.89
7.			3.71	3.70	5.14	5.66	2.88	2.91	2.88	2.94
8.			4.07	4.60	4.31	4.25	3.98	4.10	2.92	3.01
9.			3.36	3.45	3.62	3.69	3.48	3.46	3.80	3.54
10.			3.24	3.35	3.29	3.31	3.11	3.18	4.02	4.14
11.			3.03	3.10	3.21	3.29	3.00	3.08	3.68	3.82
12.			2.90	3.00	3.31	3.36	2.93	2.98	4.18	3.72
13.			2.94	3.00	3.10	3.11	3.26	3.54	6.27	6.60
14.			2.64	2.70	2.90	2.94	3.22	3.28	4.98	5.26
15.			2.50	2.55	2.75	2.76	3.14	3.21	4.88	4.88
16.			2.55	2.40	2.67	2.66	3.22	3.21	4.85	4.61
17.			2.54	2.55	2.59	2.64	3.12	3.20	4.81	5.05
18.			2.41	2.36	2.66	2.74	5.46	5.24	4.12	4.30
19.			2.30	2.36	2.92	3.00	4.36	4.64	3.73	3.82
20.			2.26	2.29	2.76	2.76	3.82	4.18	3.40	3.34
21.			2.23	2.26	2.64	2.68	3.63	3.66	3.31	3.38
22.			2.18	2.20	2.57	2.60	3.43	3.52	3.28	3.38
23.			2.15	2.19	2.56	2.62	3.31	3.36	4.11	4.22
24.			2.08	2.16	2.60	2.62	3.88	3.79	3.71	3.85
25.	1.81	1.75	2.11	2.11	2.54	2.55	3.79	3.94	3.88	3.46
26.	1.96	1.96	2.11	2.16	2.45	2.49	3.49	3.59	3.32	3.29
27.	1.97	1.86	2.13	2.14	2.42	2.48	3.35	3.38	3.83	3.88
28.	3.72	3.60	2.09	2.08	2.41	2.49	4.27	3.76	3.39	3.52
29.	5.78	5.70	2.16	2.20	2.37	2.36	4.84	5.46	.....	2.84
30.	3.86	3.65	2.59	2.70	2.36	2.45	3.78	4.05	.....	3.01
31.	3.08	3.15	.....	.....	2.38	2.45	.....	.....	.....	3.18

NOTE.— For the purpose of comparison gage heights for August 25 to December 28 have been published for both the chain and automatic gages. Note that owing to the fact that the mouth of the intake pipe to the automatic gage is located a few feet downstream from the chain gage, the gage readings do not agree exactly, owing to slope and that the slope varies with stage. The daily gage heights for the automatic gage are the mean of 24 readings taken at 60 minute intervals. The daily chain gage readings are the mean of two readings which are usually taken at 8 a. m. and 5 p. m.

*Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for 1910.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	150	672	19,500	1,070	3,390	672	187	121	140	226	470	1,290
2.....	150	568	17,000	919	8,340	614	148	154	228	191	420	1,290
3.....	150	756	14,000	783	7,880	638	98	148	226	169	391	1,170
4.....	150	568	9,730	894	8,180	560	109	132	239	211	482	1,130
5.....	150	500	8,250	868	4,360	591	169	132	211	178	308	1,060
6.....	150	450	9,380	783	3,030	575	169	121	432	191	260	868
7.....	150	450	20,300	698	2,210	575	114	73	672	284	319	783
8.....	150	400	6,740	614	1,780	538	114	73	552	351	308	715
9.....	150	400	4,750	664	1,560	517	157	126	374	284	319	647
10.....	150	400	3,290	583	1,440	489	157	169	298	252	800	600
11.....	150	350	2,840	560	1,240	489	157	239	226	239	1,780	550
12.....	150	350	2,710	470	1,100	517	140	191	201	191	1,220	500
13.....	150	350	3,230	445	988	451	284	102	239	80	1,240	450
14.....	150	400	2,270	408	868	391	656	102	226	114	988	400
15.....	150	400	1,870	426	783	335	408	154	169	184	1,080	350
16.....	150	400	1,740	445	698	426	298	169	211	114	1,020	300
17.....	150	350	1,540	510	698	451	284	84	160	169	1,040	300
18.....	150	350	1,310	1,190	614	391	239	107	91	169	928	250
19.....	2,450	350	1,520	2,390	672	368	198	201	160	148	885	250
20.....	2,210	400	4,840	3,110	538	335	391	191	160	169	800	200
21.....	2,130	400	5,220	3,250	591	313	126	102	148	218	732	200
22.....	8,600	400	3,980	2,800	496	298	107	154	132	148	647	200
23.....	4,580	350	4,260	1,710	517	284	107	126	114	132	732	200
24.....	2,990	300	4,110	7,720	698	239	91	148	140	218	800	200
25.....	2,540	300	4,260	14,900	732	194	184	77	169	201	1,950	200
26.....	1,580	300	3,110	19,700	868	201	191	160	160	252	1,950	200
27.....	1,520	2,000	2,260	8,600	758	222	102	91	591	391	1,400	200
28.....	1,220	11,700	1,810	4,580	647	187	148	69	408	408	1,130	200
29.....	1,020	.....	1,590	5,580	538	178	154	126	335	568	1,150	400
30.....	902	.....	1,200	6,260	614	169	132	98	284	432	1,980	6,000
31.....	817	.....	1,190	.....	758	.....	91	126	.....	496	.....	3,000

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge for the periods during which ice was present, January 1 to 18, February 5 to 27 and December 10 to 31, approximately determined from climatological records and the discharge at Rochester. It should be noted that the determination of the daily discharge for January 1 to 18, February 5 to 27 and December 10 to 31 have been revised and supersede those previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York.

*Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for 1911.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.
1.....	2,660	1,300	1,660	1,600	1,100	663	237	108
2.....	4,020	1,250	1,530	961	2,530	421	178	116
3.....	9,680	1,100	1,200	1,300	1,660	480	188	110
4.....	4,020	1,100	916	1,410	1,300	317	182	150
5.....	2,370	916	648	4,470	1,050	377	121	514
6.....	1,470	663	600	7,120	916	349	156	218
7.....	1,200	433	600	10,400	828	916	144	587
8.....	1,100	587	663	4,950	1,200	550	147	218
9.....	1,100	872	743	3,400	625	440	77	182
10.....	1,000	828	1,930	4,020	587	377	83	132
11.....	1,100	663	3,810	3,030	625	317	121	105
12.....	5,990	587	5,990	2,530	587	361	63	118
13.....	4,020	663	6,260	1,930	587	4,950	132	77
14.....	4,470	587	5,200	1,930	446	2,220	132	138
15.....	7,720	587	4,950	2,860	408	1,150	100	61
16.....	3,210	872	2,220	2,070	414	872	81	396
17.....	2,220	828	1,930	2,070	446	663	138	268
18.....	1,660	8,340	1,790	1,790	480	514	175	214
19.....	1,200	4,950	1,100	1,600	663	480	182	218
20.....	900	2,690	1,300	3,030	663	389	203	110
21.....	800	1,930	1,150	3,030	587	333	199	178
22.....	700	1,530	2,690	2,860	514	282	165	110
23.....	700	1,200	5,200	2,530	440	322	150	105
24.....	650	1,100	2,530	2,220	1,100	307	159	100
25.....	600	1,000	1,600	1,660	786	268	218	.....
26.....	650	1,000	2,370	1,410	480	268	86	.....
27.....	1,000	3,400	8,980	1,200	396	307	105	.....
28.....	9,330	2,860	8,030	1,050	389	383	93	.....
29.....	4,020	.....	3,210	916	287	317	165	.....
30.....	3,810	.....	2,370	881	225	268	63	.....
31.....	1,930	.....	1,930	.....	307	.....	116	.....

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge for the periods during which relation of gage height to discharge was affected by ice, January 7 to 11, 19 to 27, February 23 to 26 and March 6 to 7, estimated from climatological records and the discharge at Rochester.

Daily discharge, in second-feet, from automatic and chain gage, of Genesee River at St. Helena, N. Y.  
for August 25 to December 28, 1911.

DAY.	AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1			683	663	602	655	846	916	1,320	1,470
2			536	514	2,280	2,690	820	846	1,150	1,150
3			446	480	1,620	1,470	663	671	1,030	1,080
4			372	327	1,280	1,290	572	572	837	794
5			297	302	2,120	1,960	521	521	881	907
6			1,870	3,030	1,210	1,080	493	507	837	735
7			1,660	1,530	4,200	5,100	768	752	768	777
8			2,180	2,860	2,560	2,300	2,040	2,070	802	837
9			1,230	1,250	1,530	1,520	1,370	1,260	1,780	1,340
10			1,110	1,150	1,160	1,110	979	988	2,100	2,130
11			907	916	1,080	1,090	881	898	1,610	1,690
12			786	828	1,180	1,180	811	811	2,340	1,560
13			820	828	970	925	1,130	1,340	7,300	7,720
14			572	587	785	777	1,090	1,080	3,850	4,150
15			473	480	663	633	1,010	1,020	3,620	3,360
16			507	383	595	558	1,090	1,020	3,560	2,880
17			500	480	536	543	988	1,010	3,480	3,620
18			414	361	587	617	5,000	4,110	2,250	2,370
19			344	361	802	828	2,640	2,930	1,690	1,690
20			322	322	671	633	1,800	2,190	1,280	1,140
21			307	307	572	572	1,540	1,480	1,180	1,180
22			277	277	521	514	1,310	1,320	1,150	1,180
23			264	273	514	529	1,180	1,160	2,240	2,250
24			233	259	543	529	1,890	1,650	1,660	1,720
25	138	118	246	237	500	480	1,750	1,850	1,250	1,260
26	188	182	246	259	440	440	1,380	1,400	1,190	1,090
27	192	150	307	251	421	433	1,220	1,180	1,180	1,760
28	1,670	1,410	237	226	414	440	2,500	1,610	1,26	1,360
29	5,860	5,200	268	277	383	361	3,540	4,610	.....	665
30	1,860	1,470	536	587	379	414	1,750	2,000	.....	837
31	961	961	.....	.....	389	414	.....	.....	.....	988
Mean.....	1,550	1,360	631	687	1,020	1,030	1,450	1,460	1,830	1,800

NOTE.—Daily discharge August 25 to December 31 determined from a well-defined discharge rating curve based on measurements referred to the chain gage, same rating curve being used on both sets of gage heights. The daily discharge was determined for the automatic gage record from the chain gage rating by means of the following well-defined table of relation, which serves to reduce the automatic gage readings to the corresponding chain gage readings. Discharge December 29 to 31 taken from chain gage record; automatic gage not running.

Except for errors caused by diurnal fluctuations of stage and inaccuracies of observation, the determination should be strictly comparable. The determinations referred to the automatic gage should, of course, be given preference.

Table for Genesee River at St. Helena, N. Y., changing automatic to chain gage heights, for 1911

AUTO.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1.80	1.81	.....	.....	.....	.....	.....	.....
1.90	1.92	.....	.....	.....	.....	.....	.....
2.00	2.02	4.00	4.10	6.00	6.18	8.00	8.26
2.10	2.12	4.10	4.20	6.10	6.28	.10	.....
2.20	2.23	4.20	4.31	6.20	6.39	.20	.....
2.30	2.33	4.30	4.41	6.30	6.49	.30	.....
2.40	2.44	4.40	4.52	6.40	6.60	.40	.....
2.50	2.54	4.50	4.62	6.50	6.70	.50	.....
2.60	2.64	4.60	4.72	6.60	6.80	.60	.....
2.70	2.75	4.70	4.83	6.70	6.91	.70	.....
2.80	2.85	4.80	4.93	6.80	7.01	.80	.....
2.90	2.95	4.90	5.04	6.90	7.12	.90	.....
3.00	3.06	5.00	5.14	7.00	7.22	.00	.....
3.10	3.16	5.10	5.24	7.10	7.32	.10	.....
3.20	3.27	5.20	5.34	7.20	7.43	.20	.....
3.30	3.37	5.30	5.45	7.30	7.53	.30	.....
3.40	3.48	5.40	5.56	7.40	7.64	.40	.....
3.50	3.58	5.50	5.66	7.50	7.74	.50	.....
3.60	3.68	5.60	5.76	7.60	7.84	.60	.....
3.70	3.79	5.70	5.87	7.70	7.95	.70	.....
3.80	3.89	5.80	5.97	7.80	8.05	.80	.....
3.90	4.00	5.90	6.08	7.90	8.16	.90	.....



## FIRST ANNUAL REPORT OF THE

Monthly discharge of Genesee River at St. Helena, N. Y., for 1910.  
[Drainage area, 1,030 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				Run-off.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	8,600	.....	1,140	1.11	1.28	C
February.....	11,700	.....	880	.854	.89	D
March.....	20,300	1,190	5,480	5.32	6.13	A
April.....	19,700	408	3,100	3.01	3.86	A
May.....	8,340	496	1,860	1.81	2.09	A
June.....	672	169	407	.395	.44	A
July.....	656	91	191	.185	.21	A
August.....	239	69	131	.127	.15	A
September.....	672	91	256	.249	.28	A
October.....	568	80	238	.231	.27	A
November.....	1,980	260	918	.891	.99	A
December.....	.....	.....	778	.763	.88	C
The year.....	.....	.....	1,280	1.24	16.97	

NOTE.—The computations for January, February, December and the year have been revised and supersede those previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York.

Monthly discharge Genesee River at St. Helena, N. Y., for 1911.  
[Drainage area, 1,030 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.										Run-off depth in inches on drainage area.	Accu- racy	
	MAXIMUM.						MEAN.						
	Automatic Gage.				Chain Gage.		Mini- mum.	Auto- matic gage.	Chain gage.	Per square mile.			
	Day.	Hour.	Crest gage height.	Crest dis- charge.	Date.	24 hr. dis- charge							
January....						9,680	600	.....	2,750	2.67	3.08	C	
February...						8,340	433	.....	1,570	1.52	1.58	B	
March.....						8,980	600	.....	2,760	2.67	3.08	A	
April.....						10,400	881	.....	2,670	2.59	2.89	A	
May.....						2,530	225	.....	730	.709	.82	A	
June.....						4,950	268	.....	662	.643	.72	A	
July.....						237	63	.....	141	.137	.16	B	
August.....	28	9.15 p.m.	7.92	12,600	Aug. 29	5,200	61	.....	497	.452	.56	A	
September...	8	11.30 a.m.	6.30	4,240	Sept. 6	3,030	233	.....	631	.687	.68	A	
October.....	7	11.30 a.m.	6.08	6,210	Oct. 7	5,100	379	.....	1,030	1.030	1.14	A	
November...	18	10.30 a.m.	6.44	7,240	Nov. 29	4,610	493	.....	1,450	1.460	1.57	A	
December...	13	6 a.m.	6.70	8,080	Dec. 13	7,730	698	.....	1,830	1.800	2.05	A	
Year....	Aug. 28	9.15 p.m.	7.92	12,600	.....	10,400	61	.....	1,390	1.390	11.35	18.33	

<sup>a</sup> Missing records January 1 to August 24, and December 29 to 31 completed from chain gage record.

<sup>b</sup> Computed from mean monthly discharge in automatic gage column.

<sup>c</sup> From automatic gage record.

NOTE.—In computing the monthly mean for August, December and the annual mean, the automatic gage records have been used as far as available, as they are considered preferable. For the purposes of comparison, the 24-hour maximum for the chain gage and the monthly means for the chain gage are presented in the table above for the period August 25 to December 31.

*Genesee River at Jones' Bridge near Mt. Morris, N. Y.*

*Location.*—At the highway bridge known as Jones' Bridge, about 5 miles below the village of Mt. Morris, 6 miles by river above the village of Geneseo,  $1\frac{1}{4}$  miles below the inflow of Canaseraga creek (coming in from the right) and about  $1\frac{1}{4}$  miles above the mouth of Beads creek (coming in from the left).

*Records available.*—May 22, 1903, to April 30, 1906; August 12, 1908, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—1,410 square miles.

*Gage.*—Chain, fastened to upstream side of highway bridge; read twice daily; datum unchanged since established.

*Channel.*—Sandy clay; liable to shift, but measurements have shown it to be fairly permanent in recent years.

*Discharge measurements.*—Made at all stages from foot bridge erected on the outriggers of the bridge.

*Winter flow.*—Relation between gage height and discharge for the winter months considerably affected by ice. Volume of flow during the winter months determined chiefly by comparison with the flow of the Genesee at Rochester and at St. Helena.

*Accuracy.*—Discharge curve well developed and data as published for open water periods believed to be excellent.

*Co-operation.*—Established by United States Geological Survey in 1903 in co-operation with the State Engineer and Surveyor of New York; re-established in 1908 in co-operation with the State of New York Water Supply Commission.

*Discharge measurements of Genesee River at Jones' Bridge, near Mt. Morris, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Mar. 15.....	C. C. Covert.....	160	1,540	14.00	6,590
Mar. 30.....	W. G. Hoyt.....	151	915	9.92	3,750
Aug. 28.....	Frank Weber.....	80	217	4.36	378
Aug. 28.....	C. S. De Golyer.....	85	283	5.16	784

Daily gage height, in feet, of Genesee River at Jones' Bridge, near Mt. Morris, N. Y., for 1911.

[Elizabeth Trever, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.4	13.1	13.8	8.2	6.2	4.3	3.95	2.6	5.5	5.5	5.1	6.7
2	12.4	12.5	13.6	7.4	8.8	4.6	3.8	2.6	4.95	7.0	5.5	6.2
3	22.3	11.6	12.4	7.0	7.5	4.6	2.85	3.5	4.75	7.5	5.2	5.9
4	18.6	11.2	11.4	7.0	6.7	4.55	4.0	3.6	4.5	8.1	5.1	5.52
5	14.1	10.9	11.0	10.2	6.2	4.3	3.7	3.85	4.35	6.9	4.76	5.6
6	13.2		10.0	16.7	6.0	4.55	3.7	4.3	6.5	6.6	4.8	5.6
7	13.1	10.4	9.2	19.1	5.7	4.5	3.7	3.9	7.8	8.0	4.95	5.5
8	13.2		8.5	14.9	5.5	5.1	3.6	2.8	8.6	6.9	7.4	5.6
9	12.8		9.1	11.2	5.4	4.65	3.55	2.85	6.7	6.4	6.5	5.8
10	12.4		14.4	11.1	5.2	4.55	3.6	2.6	5.9	6.2	5.8	8.0
11		9.4	16.0	10.0	5.2	4.4	3.6	2.6	5.7	6.0	5.4	7.2
12	15.0		18.4	9.1	5.2	4.45	3.45	2.45	5.4	6.2	5.4	6.7
13	20.1		20.4	8.3	4.9	7.7	3.35	2.35	5.5	5.8	6.0	14.4
14	19.5		17.7	7.8	4.85	7.9	3.55	2.45	5.1	5.4	6.0	13.2
15	22.3		14.7	8.5	4.65	6.1	3.35	2.35	4.8	5.2	5.8	10.1
16	19.4	9.5	9.3	7.8	4.75	5.4	3.2	2.65	4.7	5.0	5.7	10.7
17	16.3		8.8	8.0	4.8	5.0	3.75	4.25	4.85	5.0	5.7	10.9
18	14.8	9.8	7.8	7.7	4.8	4.95	4.0	3.85	4.55	5.2	8.5	9.1
19	13.9	22.4	7.3	7.2	4.8	4.65	3.7	3.9	4.5	5.4	10.4	7.6
20	13.0	18.5	6.95	8.5	5.3	4.5	3.7	3.75	4.3	5.2	7.6	6.8
21	12.4	16.6	7.7	10.5	5.0	4.3	3.7	3.6	4.2	5.0	7.1	6.5
22	12.2	15.1	8.9	8.2	4.65	4.2	3.7	3.55	4.3	4.85	6.6	6.2
23	11.2	14.6	11.8	8.0	4.75	4.2	3.55	3.3	4.15	4.8	6.2	7.0
24	12.1	14.5	9.1	7.8	5.7	4.2	3.6	3.4	4.05	4.8	6.6	7.6
25	11.8	14.4	7.7	7.0	5.5	4.1	3.7	3.65	4.0	4.8	7.7	6.6
26	11.3	14.2	8.4	6.6	4.85	4.15	3.75	3.6	4.1	4.7	6.7	6.3
27	11.8	14.4	16.8	6.1	4.7	4.15	3.5	3.8	4.1	4.6	6.4	7.0
28	21.8	14.0	19.3	6.0	4.4	4.3	3.5	4.5	4.1	4.55	6.8	7.1
29	20.4		11.5	5.75	4.3	4.45	3.45	15.4	4.15	4.51	11.0	5.6
30	15.4		9.8	5.75	4.15	4.1	3.5	8.2	4.4	4.51	8.0	6.7
31	13.7		8.8		4.05		3.5	6.7		4.51		7.1

NOTE.—Gage heights at this station during each winter period greatly affected by back-water from ice jams. It is probable that the relation of gage height to discharge was affected from this cause from about January 1 to about March 11. Gage readings were probably to water surface. Probably no back-water during December.

Daily discharge, in second-feet, of Genesee River at Jones' Bridge, near Mt. Morris, N. Y., for 1910.

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		17,800	1,340	5,880	960	190	175	205	300	575	1,700
2		17,700	1,200	8,440	835	138	190	250	318	530	1,450
3		17,500	1,090	10,100	810	138	190	265	265	490	1,280
4		16,300	1,060	12,400	735	138	175	306	265	552	
5		14,800	1,060	8,200	710	190	162	318	205	470	
6		14,100	1,040	4,980	735	162	162	598	265	390	
7		16,200	935	3,440	760	205	112	760	370	390	
8		14,500	860	2,660	760	175	125	665	470	410	
9		11,300	785	2,630	710	175	138	510	370	410	
10		9,840	710	2,060	665	60	162	390	352	575	
11		4,620	785	1,820	620	150	250	282	335	1,560	
12		3,750	785	1,480	642	150	265	282	318	1,450	
13		3,330	735	1,370	620	190	175	300	300	1,060	
14		2,890	665	1,260	530	598	205	300	282	1,060	
15		2,630	620	1,090	490	575	138	220	205	1,060	
16		2,270	620	1,010	530	470	205	300	90	1,060	
17		2,090	665	960	510	370	138	300	138	1,060	
18		1,850	1,090	885	450	352	109	125	250	1,010	
19		1,790	2,270	810	450	335	220	265	175	910	
20		4,060	2,890	760	510	300	282	265	205	910	
21		6,320	3,220	810	490	205	250	220	162	835	
22		4,760	3,610	810	430	235	125	220	162	810	
23		4,730	2,430	785	370	175	175	175	90	760	
24		4,240	4,590	810	335	100	162	150	175	735	
25		4,420	13,400	985	265	175	162	80	265	1,700	
26		3,920	15,300	1,040	235	195	220	235	318	2,000	
27		2,890	15,100	985	265	215	175	265	490	1,530	
28	7,900	2,300	10,400	885	282	235	175	490	450	1,230	
29		1,880	6,280	785	282	175	80	390	530	1,940	
30		1,620	9,680	760	250	190	175	370	620	2,210	
31		1,420		785		60	235		575		

NOTE.—Daily discharge determined from a well-defined discharge rating curve. The determinations of daily discharges previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York, have been revised but are not republished because approximate.

*Daily discharge in second-feet of Genesee River at Jones' Bridge near Mt. Morris, N. Y., for 1911.*

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3,000	2,530	1,340	410	282	175	960	960	760	1,620
2.....	2,400	2,030	2,920	530	235	175	688	1,790	960	1,340
3.....	1,900	1,790	2,090	530	250	150	598	2,090	810	1,180
4.....	1,500	1,790	1,620	510	300	175	490	2,460	760	970
5.....	1,200	3,890	1,340	410	205	250	430	1,730	602	1,010
6.....	1,000	8,920	1,230	510	205	410	1,500	1,560	620	1,010
7.....	900	10,800	1,060	490	205	265	2,270	2,400	688	960
8.....	950	7,480	960	760	175	235	2,790	1,730	2,030	1,010
9.....	1,000	4,590	910	552	162	250	1,620	1,450	1,500	1,120
10.....	2,500	4,520	860	510	175	175	1,180	1,340	1,120	2,400
11.....	5,000	3,750	810	450	175	175	1,060	1,230	910	1,910
12.....	10,300	3,120	810	470	138	138	910	1,340	910	1,620
13.....	11,900	2,600	665	2,210	112	90	960	1,120	1,230	7,080
14.....	9,720	2,270	642	2,340	162	138	760	910	1,230	6,120
15.....	7,320	2,720	552	1,280	112	112	620	810	1,120	3,820
16.....	3,260	2,270	598	910	80	190	575	710	1,060	4,240
17.....	2,920	2,400	620	710	220	390	642	710	1,060	4,380
18.....	2,270	2,210	620	688	300	250	510	810	2,720	3,120
19.....	1,970	1,910	620	552	205	265	490	910	4,030	2,150
20.....	1,760	2,720	860	490	205	220	410	810	2,150	1,670
21.....	2,210	4,100	710	410	205	175	370	710	1,850	1,500
22.....	2,980	2,530	552	370	205	162	370	642	1,560	1,340
23.....	5,020	2,400	598	370	162	100	352	620	1,340	1,790
24.....	3,120	2,150	1,060	370	175	125	318	620	1,560	2,150
25.....	2,210	1,790	960	335	205	190	300	620	2,210	1,560
26.....	2,660	1,560	642	352	220	175	335	575	1,620	1,400
27.....	9,000	1,280	575	352	150	235	335	530	1,450	1,790
28.....	11,000	1,230	450	410	150	490	335	510	1,670	1,850
29.....	4,800	1,090	410	470	138	7,880	352	494	4,450	1,010
30.....	3,610	1,090	352	335	150	2,530	450	494	2,400	1,620
31.....	2,920	.....	318	.....	150	1,620	.....	494	.....	1,850

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge March 1 to 11, estimated from the determination of discharge at St. Helena and at Rochester.

*Monthly discharge of Genesee River at Jones' Bridge near Mt. Morris, N. Y., for 1910.*  
[Drainage area, 1,410 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....	.....	.....	1,400	.993	1.14	C
February.....	7,900	.....	1,000	.709	.74	C
March.....	17,800	1,420	6,690	4.96	5.72	C
April.....	15,300	620	3,510	2.49	2.78	C
May.....	12,400	760	2,630	1.86	2.14	C
June.....	960	235	541	.384	.43	B
July.....	598	60	226	.160	.18	B
August.....	282	80	178	.126	.15	B
September.....	760	80	316	.224	.25	B
October.....	620	90	300	.213	.25	B
November.....	2,210	390	989	.701	.78	B
December.....	.....	.....	900	.638	.74	C
The year.....	17,800	60	1,580	1.12	15.30	

NOTE.—Monthly discharge for January, February, and December computed from the discharge at St. Helena and Rochester, with due consideration to the relative drainage areas.  
The computations for the winter months and the year have been revised and supersede those previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.

Monthly discharge of Genesee River at Jones' Bridge near Mt. Morris, N. Y., for 1911.  
[Drainage area, 1,410 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....			3,500	2.48	2.86	C
February.....			2,200	1.56	1.62	C
March.....	11,900	900	3,960	2.80	3.23	A
April.....	10,800	1,090	3,120	2.21	2.47	A
May.....	2,920	318	897	.636	.73	A
June.....	2,340	335	637	.452	.60	A
July.....	300	80	187	.133	.15	B
August.....	7,880	90	577	.409	.47	A
September.....	2,790	300	767	.544	.61	A
October.....	2,460	494	1,070	.759	.88	A
November.....	4,450	602	1,550	1.10	1.23	A
December.....	7,080	960	2,150	1.52	1.75	A
The year.....	11,900	80	1,710	1.21	16.50	

NOTE.—Monthly discharge for January and February, computed from the discharge at St. Helena and Rochester, with due consideration of the relative drainage areas.

#### Genesee River at Rochester, N. Y.

*Location.*—At the highway bridge known locally as Elmwood Avenue Bridge, at the northern end of South Park,  $3\frac{1}{4}$  miles above the center of the city of Rochester,  $4\frac{1}{4}$  miles below the mouth of Black creek (coming in from the left) and  $7\frac{1}{2}$  miles above the mouth of the river.

*Records available.*—February 9, 1904, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York. Elevation of water surface, measurements, and records of flow of Genesee river at Rochester during flood stages and low water previous to 1904, published in annual reports of the State Engineer and Surveyor, 1902–1903–1904 and in Water Supply Papers 24, 65 and 97.

*Drainage area.*—2,360 square miles.

*Gage.*—Prior to 1910, a staff gage bolted to the downstream end of the first pier from the right hand shore was read once daily. From December, 1910, to December, 1911, mean gage heights computed from a Gurley recording gage in the pump house immediately below the bridge on the right hand bank. Elevation of zero of gage, 506.848 Barge Canal datum and 245.591 Rochester City datum. Gage datum unchanged since installation of the station.

*Channel.*—Gravel, smooth; considered permanent.

*Discharge measurements.*—Made from bridge at which the staff gage is located. Prior to 1904, measurements and elevations of water surface taken in conjunction with the water flowing over and around Johnson-Seymour dam in the city of Rochester.

*Winter flow.*—Affected by ice for short periods although as a rule the channel is open.

*Accuracy.*—Discharge rating curve well developed for all stages; published data considered good for periods of open water.

*Co-operation.*—Maintained by the United States Geological Survey in co-operation with the New York State Barge Canal and the engineer department of the City of Rochester from 1904 to 1909; from December, 1909, maintained in co-operation with the State of New York Conservation Commission, and the engineer department, city of Rochester.

*Discharge measurements of Genesee River at Rochester, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Mar. 29.....	W. G. Hoyt.....	372	3,240	6.79	13,800
Mar. 29.....	W. G. Hoyt.....	368	3,210	6.36	13,110
April 1.....	W. G. Hoyt.....	359	1,990	3.43	4,300
Aug. 14 a.....	C. S. De Golyer.....	350	1,020	1.03	204
Aug. 14 a.....	W. G. Hoyt.....	326	1,040	1.02	218
Aug. 29.....	Frank Weber.....	347	1,120	1.18	448
Sept. 21.....	W. G. Hoyt.....	335	1,060	1.16	501

a Temporary earth dam below station caused back-water.

*Daily gage height, in feet, of Genesee River at Rochester, N. Y., for 1911.*

*DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.55	3.84	4.42	3.26	2.28	1.49	1.3	1.3	1.89	1.18	1.34	2.87
2.....	3.62	3.31	3.83	3.02	2.48	1.52	1.3	1.3	1.58	1.42	1.56	2.44
3.....	4.08	2.76	3.30	2.87	2.57	1.56	1.3	1.3	1.45	2.38	1.75	2.18
4.....	4.99	2.46	2.94	2.80	2.58	1.57	1.3	1.3	1.32	2.31	1.64	2.01
5.....	5.15	2.30	2.75	3.69	2.43	1.53	1.2	1.3	1.27	2.04	1.56	1.85
6.....	3.82	2.41	2.40	6.37	2.24	1.58	1.2	1.3	1.29	2.46	1.47	1.84
7.....	2.88	2.60	2.20	6.67	2.08	1.77	1.2	1.2	2.11	2.19	1.48	1.83
8.....	2.65	2.62	2.04	6.60	1.93	1.70	1.4	1.2	2.33	3.65	1.57	1.79
9.....	2.75	2.43	2.09	4.80	1.87	1.85	1.7	1.2	2.69	3.14	2.49	1.77
10.....	2.97	1.99	2.89	4.40	1.84	1.73	1.7	1.1	2.22	2.64	2.29	2.14
11.....	2.63	2.22	4.29	4.29	1.68	1.56	1.7	1.1	1.93	2.07	2.01	2.77
12.....	2.98	1.94	5.34	4.06	1.29	1.49	1.6	1.1	1.83	1.99	1.84	2.55
13.....	4.14	1.72	6.43	3.66	1.4	2.03	1.6	1.1	1.67	2.04	1.78	3.11
14.....	4.81	1.68	6.83	3.36	1.79	3.05	1.5	1.1	1.68	1.89	2.00	5.43
15.....	4.77	2.31	6.65	3.26	1.75	2.41	1.5	1.1	1.52	1.73	2.04	4.71
16.....	5.48	2.20	5.56	3.54	1.74	2.15	1.5	1.1	1.40	1.59	1.94	4.13
17.....	4.60	1.68	3.84	3.29	1.72	1.84	1.5	1.1	1.33	1.53	1.93	4.10
18.....	3.56	3.02	3.37	3.18	1.73	1.65	1.5	1.1	1.31	1.48	1.94	4.00
19.....	3.09	5.50	3.13	3.04	1.74	1.55	1.5	1.0	1.32	1.46	3.56	3.32
20.....	2.65	6.07	2.95	3.02	1.73	1.55	1.5	1.0	1.19	1.62	3.63	2.79
21.....	2.57	4.66	3.09	3.67	1.86	1.54	1.5	1.0	1.16	1.59	2.82	2.36
22.....	2.74	3.71	3.32	3.70	1.82	1.43	1.5	1.06	1.15	1.51	2.55	2.28
23.....	2.80	3.21	4.55	3.33	1.74	1.37	1.5	1.02	1.13	1.43	2.35	2.36
24.....	2.46	2.89	4.76	3.27	1.76	1.35	1.4	.99	1.10	1.42	2.22	3.01
25.....	2.08	2.76	3.51	3.10	2.09	1.40	1.4	.99	1.05	1.43	2.53	2.86
26.....	1.96	3.04	3.17	2.81	2.06	1.2	1.4	1.01	1.08	1.42	2.74	2.46
27.....	2.17	4.40	3.84	2.61	1.81	1.2	1.3	1.01	1.08	1.45	2.44	2.40
28.....	3.60	4.94	6.46	2.47	1.66	1.2	1.3	1.03	1.07	1.36	2.27	2.68
29.....	5.65	.....	6.56	2.35	1.55	1.3	1.3	2.31	1.09	1.33	2.65	2.31
30.....	5.67	.....	5.24	2.27	1.52	1.4	1.3	4.11	1.10	1.27	3.75	1.64
31.....	4.50	.....	.....	.....	1.47	.....	1.3	2.62	.....	1.32	.....	1.79

\* Automatic gage.

*NOTE.*—Daily gage heights recorded by the automatic gage, except May 13, and June 26 to August 21, which were observed at 4 P. M. on the staff gage. Relation of gage height to discharge probably not materially affected by ice during the winter months.

The gage heights July 8 to August 28 were affected by an earth dam put in below the gage. The daily automatic gage heights are the mean of 24 records taken at 1-hour intervals. There is probably no difference between the automatic and staff gage heights resulting from slope in water surface or other cause.

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1910.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	320	1,600	13,200	1,960	11,400	1,300	405	320	174	610	500	(2,640)
2.....	320	1,600	15,100	1,960	9,620	1,300	465	320	320	610	610	2,180
3.....	320	1,600	21,400	1,600	13,200	1,300	405	320	320	610	610	1,970
4.....	320	1,600	28,200	1,450	16,100	1,150	405	285	320	610	610	1,760
5.....	320	1,600	29,000	1,450	15,800	1,150	405	285	320	610	610	1,620
6.....	320	1,600	26,600	1,450	9,620	1,300	388	250	1,000	730	610	1,450
7.....	320	1,600	24,700	1,300	5,800	1,300	362	250	1,960	1,000	610	1,300
8.....	320	1,450	23,600	1,300	4,600	1,300	337	250	1,600	1,000	610	1,450
9.....	320	1,450	22,500	1,300	3,720	1,300	320	250	860	860	610	1,780
10.....	320	1,300	18,500	1,300	2,500	1,150	320	250	860	730	610	1,150
11.....	320	1,150	10,500	1,150	3,100	1,150	320	320	730	730	730	1,150
12.....	320	1,150	6,840	1,150	2,500	1,150	320	320	610	500	2,140	860
13.....	320	1,150	5,800	1,000	2,500	1,150	306	320	500	500	1,780	944
14.....	320	1,150	5,320	1,000	2,140	1,000	320	320	452	500	1,450	769
15.....	320	1,150	4,600	860	1,780	1,000	320	313	405	500	1,450	700
16.....	320	1,150	3,940	860	1,600	860	610	306	500	405	1,450	650
17.....	320	1,000	3,500	860	1,600	860	610	320	405	405	1,450	600
18.....	500	900	3,300	1,150	1,600	730	405	320	362	405	1,450	550
19.....	610	900	2,900	1,450	1,450	730	405	320	320	320	1,450	500
20.....	1,000	1,000	2,900	3,100	1,450	730	405	320	337	320	1,450	450
21.....	4,840	1,000	8,780	4,600	1,300	730	405	306	337	320	1,300	450
22.....	5,800	1,000	7,940	4,160	1,150	610	405	299	320	320	1,150	400
23.....	8,500	900	6,580	3,940	1,000	610	320	320	320	320	1,000	450
24.....	8,780	800	6,320	4,160	1,150	610	320	320	320	320	1,000	450
25.....	5,800	800	5,800	13,900	1,450	500	405	320	405	405	1,000	400
26.....	4,840	800	5,800	16,400	1,600	500	405	306	405	500	2,500	450
27.....	3,940	1,500	4,600	18,500	1,600	500	405	285	362	500	2,700	450
28.....	3,100	2,500	3,500	18,500	1,600	405	362	250	362	500	2,140	450
29.....	2,700	.....	2,900	13,900	1,450	405	320	238	405	500	2,140	500
30.....	1,960	.....	2,500	12,900	1,450	405	320	226	405	500	3,100	750
31.....	1,600	.....	2,140	.....	1,300	.....	320	186	.....	500	.....	.....

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge for periods during which ice existed, February 17 to 28 and December 15 to 30, determined approximately by means of climatological records.

Determinations of daily discharge for February 17 to 28 and December 15 to 30 have been revised and supersede those previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York.

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1911.

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4,240	5,420	6,890	4,070	2,100	847	610	340	1,440	481	658	3,240
2.....	4,890	4,180	5,390	3,540	2,460	888	610	340	972	756	944	2,390
3.....	6,010	3,020	4,160	3,240	2,640	944	610	340	795	2,280	1,220	1,920
4.....	8,470	2,430	3,380	3,100	2,660	958	610	340	634	2,160	1,060	1,620
5.....	8,920	2,140	3,000	5,060	2,370	902	500	340	577	1,670	944	1,380
6.....	5,370	2,340	2,320	12,500	2,030	972	500	340	599	2,430	821	1,360
7.....	3,260	2,700	1,960	13,400	1,740	1,260	500	290	1,800	1,940	834	1,340
8.....	2,800	2,740	1,670	13,200	1,500	1,150	390	290	2,190	4,960	958	1,280
9.....	3,000	2,370	1,760	7,940	1,400	1,380	540	290	2,880	3,810	2,480	1,260
10.....	3,440	1,580	3,280	6,840	1,360	1,200	540	250	2,000	2,780	2,120	1,850
11.....	2,760	2,000	6,550	6,550	1,120	944	540	250	1,500	1,730	1,620	3,040
12.....	3,460	1,510	9,450	5,960	599	847	490	250	1,340	1,580	1,260	2,600
13.....	6,160	1,180	12,700	4,980	730	1,650	490	250	1,100	1,670	1,270	3,740
14.....	7,970	1,120	14,000	4,290	1,280	3,610	440	250	1,120	1,440	1,600	9,700
15.....	7,860	2,160	13,400	4,070	1,220	2,340	440	250	888	1,200	1,670	7,690
16.....	9,840	1,960	10,100	4,700	1,210	1,690	440	250	730	986	1,510	6,140
17.....	7,380	1,120	5,420	4,140	1,180	1,360	440	250	646	902	1,500	6,060
18.....	4,740	3,540	4,310	3,900	1,200	1,080	440	250	622	834	1,510	5,800
19.....	3,700	9,900	3,790	3,590	1,210	930	440	210	634	808	4,740	4,200
20.....	2,800	11,600	3,400	3,540	1,200	930	440	210	490	1,030	4,910	3,080
21.....	2,640	7,550	3,700	5,010	1,390	916	440	210	462	986	3,140	2,250
22.....	2,980	5,100	4,200	5,080	1,330	769	440	234	452	874	2,600	2,100
23.....	3,100	3,960	7,240	4,230	1,210	694	440	218	434	769	2,230	2,250
24.....	2,430	3,280	7,830	4,090	1,240	670	390	206	405	756	2,000	3,520
25.....	1,740	3,020	4,620	3,720	1,760	730	390	206	362	769	2,560	3,220
26.....	1,540	3,590	3,870	3,120	1,710	500	390	214	388	756	2,980	2,430
27.....	1,910	6,840	5,420	2,720	1,320	500	340	214	388	795	2,390	2,320
28.....	4,840	8,330	12,800	2,450	1,090	500	340	222	380	682	2,090	2,860
29.....	10,400	.....	13,100	2,230	930	610	340	2,160	396	646	2,800	2,160
30.....	10,400	.....	9,170	2,090	888	730	340	6,090	405	577	5,200	1,060
31.....	7,100	.....	6,620	.....	821	.....	340	2,740	.....	634	.....	1,280

NOTE.—Daily discharge determined from a well-defined discharge rating curve, except from the period July 8 to August 28. For this period an approximate auxiliary curve has been used, constructed by means of two discharge measurements made August 14 and comparisons with the discharge at St. Helena and at Jones' Bridge.

Monthly discharge of Genesee River at Rochester, N. Y., for 1910.

[Drainage area, 2,360 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	8,780	320	1,920	.814	.94	B
February.....	.....	.....	1,260	.534	.56	B
March.....	29,000	2,140	10,600	4.49	5.18	B
April.....	18,500	860	4,620	1.96	2.19	B
May.....	16,100	1,000	4,130	1.75	2.02	B
June.....	1,300	405	906	.384	.43	B
July.....	610	320	379	.161	.19	B
August.....	320	186	291	.123	.14	B
September.....	1,980	174	533	.226	.25	B
October.....	1,000	320	537	.228	.26	B
November.....	3,100	500	1,290	.547	.61	B
December.....	5,150	.....	1,110	.466	.49	B
The year.....	.....	.....	2,300	.975	13.26	

NOTE.—The computations for February, December and the year have been revised and supersede those previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the State Engineer and Surveyor, State of New York.

Monthly discharge of Genesee River at Rochester, N. Y., for 1911.

[Drainage area, 2,360 square miles.]

MONTH.	MAXIMUM.				Mini- mum.	Mean.	Per square m. e.	Run-off (depth in inches.)	Accu- racy.
	Day.	Hour.	Gage height.	Dis- charge.					
			<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>		
January.....	29	11:30 a. m.	6.28	12,200	1,540	5,130	2.17	2.50	B
February.....	20	6:00 a. m.	6.41	12,600	1,120	3,810	1.61	1.68	B
March.....	29	2:00 a. m.	7.07	14,700	1,670	6,310	2.67	3.08	A
April.....	6	12 Mid't	6.89	14,100	2,090	5,110	2.17	2.42	A
May.....	3-4	All day	2.58	2,660	599	1,450	.614	.71	A
June.....	14	2:15 a. m.	3.44	4,470	500	1,080	.458	.51	A
July.....	.....	.....	.....	610	340	458	.194	.22	C
August.....	30	2:15 a. m.	4.63	7,460	206	590	.250	.29	C
September.....	9	4:30 p. m.	3.02	3,540	362	901	.382	.43	A
October.....	8	1:00 p. m.	3.89	5,540	481	1,410	.598	.69	A
November.....	19	7:00 p. m.	4.37	6,780	658	2,060	.873	.97	A
December.....	14	3:00 p. m.	5.66	10,400	1,060	3,070	1.30	1.50	A
The year.....	Mar. 29	2:00 a. m.	7.07	14,700	206	2,610	1.11	15.00	

a 24-hour maximum.



## CANASERAGA CREEK DRAINAGE BASIN.

*Description.*

Canaseraga creek, one of the most important tributaries to the Genesee river from the East, rises in the extreme northwestern corner of Steuben county and flows in a northwestern direction to its junction with the Genesee river, a short distance below the village of Mt. Morris.

Through its entire course, the creek flows through a flat, fertile valley, devoted almost entirely to the pursuit of agriculture. From the village of Dansville to Mt. Morris, a distance of  $22\frac{1}{2}$  miles, the river winds back and forth across the valley. The velocity is so slow that the large amount of silt which is brought down from the foot hills by the smaller streams is deposited in the creek bed, raising it to an elevation higher, in many cases, than the surrounding country. The deposit of silt coupled with the extreme deviation of the creek from a straight line, causes the 11,000 acres, which border on the stream, below Dansville to become annually inundated by the flood waters. The State Water Supply Commission, acting upon the petition of the people residing in the vicinity, and under the authority acquired in 1906 when the duties of the River Improvement Commission were transferred to them, have sold bonds to the extent of \$200,000 and work is now being started which is expected to alleviate much of the damage caused by flooding.

*Canaseraga Creek at Dansville, N. Y.*

*Location.*—At the highway bridge, 1 mile due west from the village of Dansville, about 2,200 feet below the mouth of Mill Brook (coming in from the right), and about 22 miles above the mouth of the creek.

*Records available.*—July 21, 1910, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—167 square miles.

*Gage.*—Staff, bolted to the downstream side of the left-hand abutment; read twice daily; datum unchanged.

*Channel.*—Sand and gravel, liable to shift during high water.

*Discharge measurements.*—At high stages made from bridge. Low water measurements made by wading below the bridge.

*Winter flow.*—The relation of gage height to discharge is affected by ice.

*Accuracy.*—Discharge rating curve not sufficiently developed to warrant the publication of table of daily discharge.

*Co-operation.*—Established and maintained by United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Canaseraga Creek at Dansville, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Mar. 31.....	W. G. Hoyt.....	68	78	2.50	242
Aug. 28 a.....	Frank Weber.....	36	41.4	1.77	25.7

a Measurement made by wading above bridge.

Daily gage height, in feet, of Canaseraga Creek at Danville, N. Y., for 1911.  
[Floyd Harter, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		3.2	2.18	2.32	2.18	1.80	1.60	2.22	2.06	2.09	2.24
2.		3.2	2.05	2.55	2.18	1.78	1.60	1.95	2.20	2.06	2.19
3.		2.95	2.10	2.42	2.05	1.75	1.62	1.94	1.99	2.03	2.22
4.		2.78	2.12	2.32	1.98	1.70	1.82	1.81	2.06	1.92	2.24
5.		2.88	3.06	2.28	2.10	1.62	1.78	1.98	2.03	1.99	2.12
6.		2.80	3.05	2.20	2.08	1.68	1.70	1.98	1.92	2.01	2.16
7.		2.55	3.85	2.12	1.98	1.70	1.68	1.84	2.89	2.18	2.19
8.		2.58	3.4	2.15	2.02	1.68	1.72	2.24	2.74	2.02	2.24
9.		2.78	2.92	2.12	1.92	1.72	1.68	2.06	2.74	2.29	2.18
10.		3.15	2.82	2.02	1.90	1.70	1.60	1.89	2.51	2.16	2.32
11.		3.4	2.72	2.02	2.05	1.72	1.68	1.81	2.24	2.08	2.24
12.		3.65	2.52	1.98	2.20	1.70	1.60	1.88	2.26	2.19	2.36
13.		3.9	2.45	1.92	2.28	1.72	1.62	1.94	2.12	2.20	3.2
14.		4.2	2.60	1.92	2.18	1.70	1.60	1.84	2.04	2.18	2.95
15.		4.2	2.48	1.90	2.05	1.65	1.80	1.81	2.04	2.26	2.69
16.		3.45	2.32	1.82	1.95	1.70	2.10	1.82	1.96	2.18	2.95
17.	2.33	3.15	2.45	2.02	1.88	2.05	1.88	1.82	1.92	2.29	2.91
18.	3.4	3.3	2.40	2.05		1.95	1.98	1.80	2.04	2.91	2.69
19.	3.6	3.3	2.30	1.92	1.82	1.82	1.88	1.88	1.94	2.59	2.64
20.	3.4	3.05	2.48	1.92	1.80	1.98	1.72	1.86	1.88	2.50	2.29
21.	3.05	2.78	2.40	1.95	1.82	1.80	1.70	1.79	1.89	2.31	2.11
22.	2.82	2.78	2.45	1.92	1.88	1.78	1.72	1.78	1.96	2.24	2.20
23.	2.35	2.75	2.62	1.95	1.82	1.75	1.72	1.81	2.01	2.18	2.59
24.	2.08	2.48	2.48	2.05	1.80	1.72	1.80	1.85	1.92	2.25	2.62
25.	2.45	2.88	2.32	2.18	1.82	1.70	2.02	1.84	1.94	2.21	2.49
26.	2.94	2.95	2.22	2.08	1.80	1.68	1.88	1.91	1.88	2.19	2.39
27.	3.4	4.15	2.12	1.98	1.88	1.65	1.72	1.82	1.99	2.18	2.81
28.	3.35	3.8	2.02	1.95	2.02	1.62	2.45	1.84	1.96	2.14	2.58
29.		2.82	1.90	1.82	1.92	1.62	2.50	1.92	1.92	2.39	2.41
30.		2.58	1.88	1.80	1.80	1.62	2.22	1.96	1.95	2.26	2.44
31.		2.35		1.95		1.60	2.20		2.14		2.75

NOTE.—No information regarding backwater from ice at this station.

#### Canaseraga Creek at Shakers' Crossing, N. Y.

Measurements have been made from the highway bridge at Shakers' Crossing, about one-half mile above the junction of Canaseraga creek with Genesee river.

Owing to the fact that during any flood period the water is backed up from the Genesee river, no gage has been installed at this place, but measurements have been referred to a reference point and are published in the following table.

The reference point to which these measurements have been referred is the top of the horizontal tie bar 20 feet from the left-hand abutment, downstream side of bridge.

#### Discharge measurements of Canaseraga Creek at Shakers Crossing, 1911.

DATE.	Hydrographer.	Width.	Area of section.	a Gage height.	c Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Mar. 15.	C. C. Covert.	89.5	612	10.6	b 1,500
Mar. 30.	W. G. Hoyt.	76	374	7.16	1,180
Aug. 28.	F. Weber.	66	132	3.85	232

a Gage datum 25 feet below reference point on horizontal tie-bar 20 feet from left abutment on down stream side of bridge.

b Some back water from Genesee river.

c Includes flow from tail races of mills at Mt. Morris. This is a diversion from Genesee river and amounts to from 200 to 300 second feet.

## KESHEQUA CREEK DRAINAGE BASIN.

*Description.*

Keshequa creek, the principal tributary to Canaseraga creek, has its source among the hills of northern Allegheny county and flows north and northeast through Nunda and Tuscarora joining Canaseraga creek near Sonyea, the home of the Craig Colony for epileptics. Throughout its length of some 20 miles it flows through a narrow valley and falls about 1,200 feet. No power is developed as the flow during the summer averages only 3 to 6 second-feet. The yearly rain fall is a little above the average for the Genesee Valley and ranges from 28 to 36 inches.

*Keshequa Creek at Sonyea, N. Y.*

*Location.*—On the second highway bridge in the village of Sonyea,  $2\frac{1}{4}$  miles above its confluence with Canaseraga creek and about 4 miles downstream from Tuscarora.

*Records available.*—July 22, 1910, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—67 square miles.

*Gage.*—Staff, fastened to a pile on the right bank directly back of and across from the Craig Colony power house; used for low water readings. Chain gage installed October 25, 1910, on upstream side of second bridge for high water readings. Gage read twice daily. The zeros of these gages are not set at the same datum.

*Channel.*—Sand and gravel; liable to shift at high stages.

*Discharge measurements.*—At high stages made from either bridge; at low stages made by wading.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—Discharge rating curve not sufficiently developed to warrant publication of table of daily discharge.

*Co-operation.*—Established and maintained by United States Geological Survey in co-operation with State of New York Conservation Commission.

*Discharge measurements of Keshequa Creek at Sonyea, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	d Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Mar. 15 .....	C. C. Covert .....	60	62.5	a 4.18	207
Mar. 31 .....	W. G. Hoyt .....	47.5	70.2	b 3.70	70
Aug. 26 .....	Frank Weber .....	23.5	11.2	c 3.00	5.6

a Gage height at staff gage, 1.86.

b Gage height at staff gage, 1.39.

c Gage height at staff gage, .73.

d Chain gage.

*Daily gage height, in feet, of Kashequa Creek at Sonyea, N. Y., for 1911.*

[Elmer E. Reynolds, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		3.70	3.72	3.58	3.18	2.95	2.90	3.05	3.15	3.20	3.40
2.		3.60	3.65	3.68	3.20	2.90	2.88	2.98	3.45	3.18	3.42
3.		3.60	3.75	3.68	3.20	2.95	2.92	2.95	3.20	3.15	3.32
4.		3.60	3.70	3.58	3.12	2.98	3.12	2.98	3.18	3.15	3.25
5.		3.60	4.70	3.48	3.10	2.88	3.00	3.00	3.15	3.15	3.20
6.		3.50	4.40	3.40	3.10	2.92	2.95	3.25	3.15	3.20	3.35
7.		3.45	4.30	3.48	3.10	3.00	3.00	3.12	4.18	3.42	3.35
8.		3.50	3.98	3.45	3.10	3.02	2.98	4.55	3.50	3.50	3.45
9.		3.65	3.95	3.40	3.05	2.98	2.95	4.50	3.42	3.52	3.52
10.		4.55	3.92	3.35	3.65	2.92	2.92	3.90	3.30	3.45	3.55
11.		4.85	3.85	3.35	3.05	2.95	2.95	3.38	3.40	3.35	3.55
12.		5.10	3.70	3.35	3.10	2.95	2.92	3.45	3.42	3.35	3.88
13.		4.65	3.62	3.28	3.32	2.92	2.88	3.38	3.40	3.38	4.75
14.		4.50	3.60	3.25	3.20	2.85	2.88	3.20	3.32	3.35	3.95
15.		4.20	3.58	3.25	3.15	2.90	2.92	3.20	3.20	3.35	4.10
16.		3.95	3.55	3.25	3.10	2.88	2.95	3.05	3.20	3.40	3.95
17.	5.40	3.70	3.58	3.28	3.05	3.28	2.98	3.00	3.15	3.42	4.02
18.	5.35	3.65	3.60	3.25	3.05	3.20	2.95	3.00	3.20	4.15	3.75
19.	4.75	3.68	3.60	3.25	3.00	2.98	2.95	3.02	3.20	4.35	3.55
20.	3.90	3.70	3.60	3.20	2.98	2.95	2.92	2.98	3.20	3.50	3.35
21.	3.80	3.70	3.60	3.15	3.00	2.98	2.90	2.98	3.20	3.50	3.35
22.	3.80	3.98	3.60	3.12	3.00	3.00	2.90	2.98	3.25	3.50	3.38
23.	3.82	3.88	3.60	3.18	3.00	3.00	2.85	3.00	3.22	3.50	4.08
24.	3.78	3.82	3.58	3.50	3.00	2.98	2.80	2.98	3.20	4.52	3.58
25.	3.68	3.70	3.55	3.35	2.98	2.95	3.02	2.92	3.20	4.05	3.45
26.	4.25	3.72	3.55	3.30	2.92	3.00	3.08	3.00	3.18	3.50	3.45
27.	4.50	4.80	3.55	3.18	2.90	3.00	3.00	3.02	3.15	3.45	3.90
28.	3.85	4.18	3.50	3.10	3.05	3.00	3.35	3.05	3.15	3.52	3.60
29.		3.82	3.40	3.02	2.95	2.88	3.25	3.08	3.15	3.70	3.45
30.		3.85	3.35	3.00	2.95	2.85	3.30	3.20	3.15	3.45	3.45
31.		3.75	.....	3.02	.....	2.88	3.08	.....	3.22	.....	3.45

NOTE.—No information available regarding backwater from ice at this station.

All gage readings for 1911 made with the chain gage except those from March 4 to 16, which were made with the staff gage and reduced to the corresponding chain gage readings by means of a curve of relation between the two gages.

#### SALMON RIVER DRAINAGE BASIN.

##### Description.

Salmon River rises in the southwestern part of Lewis county, N. Y., and flows southward and then northward, entering Lake Ontario near Port Ontario. Its drainage area comprises about 285 square miles. The topography is generally rolling in character, and the soil is sandy, rock lying near the surface in the upper part of the basin, where there are extensive tracts of virgin forest.

The mean annual precipitation is about 35 inches, and during the winter there is usually a heavy fall of snow, which often accumulates in the forest areas to a depth of several feet. The gradual melting of this snow, in the spring, tends to prevent high freshets.

The basin affords several opportunities for storage. At High Falls there is an undeveloped fall of about 110 feet, occurring in a very short distance. Considering its size, this river has rather important power possibilities.

A gaging station has been maintained in this river basin near Pulaski from 1900 to 1908 and 1911, and at Stillwater near Altmar in 1911.

*Salmon River at Stillwater Bridge near Redfield, N. Y.*

**Location.**—On Stillwater highway bridge  $6\frac{1}{4}$  miles by road east of Altmar, one-fourth mile above the proposed dam of the Ontario Power Company, seven-eighths mile below Pennock Brook (coming in from the right) and 7 miles below the mouth of North Branch (coming in from the right).

**Records available.**—June 24 to December 31, 1911.

**Drainage area.**—191 square miles.\*

**Gage.**—Chain, attached to upstream side of bridge; datum unchanged since established.

**Channel.**—Small stone and gravel.

**Discharge measurements.**—Made from bridge or by wading.

**Winter flow.**—No information; relation of gage height to discharge probably affected by ice.

**Accuracy.**—Conditions for making measurements are good and records should be excellent.

**Co-operation.**—Station established by United States Geological Survey in co-operation with the Ontario Power Company of Niagara Falls, N. Y. and State of New York Conservation Commission.

\* Measured by engineers of Ontario Power Company from topographic maps.

*Discharge measurements of Salmon River at Stillwater Bridge near Redfield, N. Y., in 1911.*

DATE.	Hydrographer	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 20.....	C. S. De Golyer.....	105	300	2.92	386
June 24 a.....	C. S. De Golyer.....	111	128	1.92	138
Sept. 16 a.....	G. H. Canfield.....	122	210	2.44	259
Oct. 8 b.....	O. M. Moulton.....	109	418	4.07	752
Oct. 19.....	O. M. Moulton.....	109	468	4.50	977
Nov. 8.....	O. M. Moulton.....	109	517	4.98	1,300
Nov. 13 c.....	O. M. Moulton.....	122	640	6.07	2,150
Nov. 15.....	C. S. De Golyer.....	111	459	d 4.38	941
Nov. 21.....	C. S. De Golyer.....	110	454	e 4.34	904
Dec. 12.....	O. M. Moulton.....	120	847	f 7.66	4,120

**NOTE.**—Angle of normal to bridge to current =  $20^{\circ}$ . A coefficient of .94 applied to discharge of all measurements made at bridge.

a Made by wading about 200 feet downstream from bridge.

b Bottom of weight held at .2 and .8 depth; discharge corrected by coefficient of .94 obtained from vertical velocity curves.

c Measurement made only at station 80 on bridge; remainder of discharge computed on basis of percentage of total discharge at station 80; obtained from other measurements.

d Staff gage below dam = 1.74.

e Staff gage below dam = 1.70.

f Staff gage below dam = 3.77.

*Daily gage height, in feet, of Salmon River at Stillwater Bridge near Redfield, N. Y., for 1911.*  
[C. A. Hall, observer.]

DAY.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		2.45	1.62	2.0	2.20	4.0	4.4
2.		2.2	1.60	1.92	2.8	3.6	4.0
3.		2.0	1.58	1.89	2.65	3.2	3.8
4.		1.90	1.60	1.76	3.5	3.0	3.7
5.		1.84	1.62	1.68	4.7	2.9	3.4
6.		1.80	1.62	3.6	4.2	2.8	3.4
7.		1.74	1.60	4.1	4.6	4.0	3.2
8.		1.70	1.61	2.95	4.1	4.8	3.1
9.		1.62	2.30	2.65	3.6	4.4	3.9
10.		1.65	1.92	2.65	3.2	4.3	5.4
11.		1.74	1.80	2.3	2.9	4.0	6.0
12.		1.86	1.78	2.45	2.7	3.8	7.7
13.		1.82	1.70	2.6	2.5	5.6	9.0
14.		1.69	1.68	2.35	2.4	4.9	6.6
15.		1.65	1.62	2.2	2.3	4.4	5.2
16.		1.65	1.78	2.5	2.25	4.0	4.9
17.		2.6	1.71	2.35	2.18	3.8	5.7
18.		3.8	1.65	2.2	3.6	4.4	5.0
19.		2.6	1.76	1.92	4.5	5.1	4.2
20.		2.15	1.79	1.85	3.9	4.7	8.8
21.		2.0	1.70	1.82	3.5	4.4	3.9
22.		1.86	1.60	2.2	3.2	4.0	3.6
23.		1.76	1.58	2.4	4.1	4.0	5.2
24.	1.92	1.95	1.59	2.2	4.0	3.8	4.9
25.	1.85	2.1	1.59	1.99	3.6	3.6	4.2
26.	1.82	1.88	1.68	1.92	3.2	3.5	3.9
27.	3.8	1.79	1.65	1.89	3.0	3.9	4.4
28.	6.0	1.74	1.91	2.25	3.1	3.4	4.3
29.	4.2	1.69	2.8	2.25	2.9	5.0	4.1
30.	2.85	1.66	2.3	2.35	2.75	4.8	3.9
31.		1.64	2.0		2.8		3.5

*Daily discharge, in second-feet, of Salmon River at Stillwater Bridge near Redfield, N. Y., for 1911.*

DAY.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		262	79	155	200	770	960
2.		200	75	139	352	605	770
3.		155	71	133	312	470	685
4.		135	75	107	570	410	645
5.		123	79	91	1,120	380	535
6.		115	79	605	860	352	535
7.		103	75	815	1,070	770	470
8.		95	77	395	815	1,180	440
9.		79	225	312	605	960	725
10.		85	139	312	470	910	1,580
11.		103	115	225	380	770	2,080
12.		127	111	262	325	685	3,870
13.		119	95	300	275	1,740	5,550
14.		93	91	238	251	1,240	2,650
15.		85	79	200	225	960	1,440
16.		85	111	275	212	770	1,240
17.		300	97	238	191	685	1,820
18.		685	85	200	605	960	1,310
19.		300	107	139	1,020	1,380	860
20.		188	113	125	725	1,120	685
21.		155	95	119	570	960	725
22.		127	75	200	471	770	605
23.		107	71	250	815	770	1,440
24.	139	145	73	200	770	685	1,240
25.	125	177	73	153	605	605	860
26.	119	131	91	139	470	570	725
27.	685	113	85	133	410	725	960
28.	2,080	103	137	212	440	535	910
29.	860	93	352	212	380	1,310	815
30.	366	87	225	238	338	1,180	725
31.		83	155		352		570

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Salmon River at Stillwater Bridge near Redfield, N. Y., for 1911.  
[Drainage area, 191 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
June 24-30.....	2,080	119	625	3.27	.85	A
July.....	685	79	153	.801	.92	A
August.....	352	71	110	.576	.66	A
September.....	815	91	237	1.24	1.38	A
October.....	1,120	191	523	2.74	3.16	A
November.....	1,740	352	841	4.40	4.91	A
December.....	5,550	440	1 240	6.49	7.48	A

*Salmon River at Fox's Bridge near Pulaski, N. Y.*

*Location.*—At a highway bridge known locally as Fox's Bridge, about 2½ miles above the village of Pulaski, 2¼ miles above Trout Brook (coming in from the left) and 6½ miles above the mouth of the river.

*Records available.*—September 5, 1900, to June 30, 1907; August 16, to December 6, 1908; July 14 to December 31, 1910, and April 1, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—264 square miles.

*Gage.*—A vertical staff attached to the upstream end of the center pier of the bridge was read from September 5, 1900 to the winter of 1901-02, when it was destroyed by ice. On July 23, 1902, a chain gage was installed the zero of which is 1.20 feet below the original staff gage zero. Datum of chain gage unchanged since established.

*Channel.*—Gravel; fairly permanent.

*Discharge measurements.*—Made either by wading or from the bridge.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—Open water curve well developed. Published data considered good.

*Co-operation.*—Maintained in co-operation with the State Engineer and Surveyor of New York prior to 1910, in co-operation with the State Conservation Commission of New York beginning July 14, 1910.

*Discharge measurements of Salmon River at Fox's Bridge near Pulaski, N. Y., in 1911.*

DATE.	Hydrographer.	W.dth.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 11.....	C. S. De Golyer.....	209	780	5.56	3,450
April 21.....	C. C. Covert.....	234	948	5.99	4,690
May 15.....	C. S. De Golyer.....	176	318	3.11	416
May 22.....	C. S. De Golyer.....	176	292	3.00	343
June 23 a.....	C. S. De Golyer.....	174	250	2.78	226
Sept. 17 a.....	G. H. Canfield.....	174	262	2.88	274
Sept. 17 a.....	G. H. Canfield.....	176	268	2.91	285
Nov. 21.....	C. S. De Golyer.....	177	474	4.00	1,120
Dec. 12.....	C. S. De Golyer.....	237	869	5.87	4,030
Dec. 14.....	C. S. De Golyer.....	234	834	5.77	3,910

a Measurement made by wading at bridge.

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*Daily gage height, in feet, of Salmon River at Pulaski, N. Y., for 1911.*  
[Seymour Fox, observer.]

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	.....	5.6	3.06	3.15	2.45	2.70	2.84	3.65	4.05
2.....	.....	6.3	3.29	2.95	2.45	2.65	2.94	3.49	3.85
3.....	4.05	5.2	3.02	2.80	2.40	2.60	3.04	3.26	3.55
4.....	3.79	4.35	2.86	2.72	2.45	2.60	3.19	3.16	3.32
5.....	4.05	4.05	3.65	2.62	2.40	2.50	4.1	3.12	3.40
6.....	4.85	3.85	4.7	2.60	2.40	4.2	3.85	3.04	3.40
7.....	6.2	3.85	3.9	2.60	2.40	4.05	4.1	3.9	3.30
8.....	6.2	3.75	3.75	2.55	2.48	3.40	3.95	4.4	3.30
9.....	5.8	3.7	3.24	2.50	.....	3.22	3.44	3.95	3.6
10.....	5.6	3.6	3.09	2.50	2.75	3.18	3.29	3.6	4.7
11.....	5.5	3.46	2.94	2.50	2.60	2.95	3.14	3.65	5.0
12.....	5.7	3.36	3.65	2.65	2.58	2.90	3.04	3.52	6.0
13.....	5.9	3.24	3.85	2.60	2.50	2.90	2.96	4.9	7.0
14.....	6.5	3.14	3.5	2.52	2.45	2.85	2.86	4.35	5.7
15.....	7.1	3.09	3.19	2.48	2.45	2.80	2.82	4.05	4.65
16.....	6.3	3.04	3.06	2.50	2.50	2.95	2.74	3.8	4.45
17.....	5.4	3.02	2.96	3.05	2.48	2.90	2.76	3.34	4.95
18.....	5.2	2.96	2.84	4.0	2.45	2.79	3.32	4.0	4.5
19.....	5.3	2.96	2.79	3.32	2.52	2.66	4.05	4.4	4.05
20.....	5.6	3.19	2.74	2.90	2.45	2.62	3.65	4.15	3.5
21.....	5.8	3.09	2.64	2.80	2.42	2.59	3.42	4.0	3.48
22.....	5.3	2.96	2.69	2.70	2.40	2.79	3.39	3.75	3.6
23.....	4.95	2.92	2.74	2.60	2.40	2.94	3.6	3.55	4.35
24.....	4.75	3.16	2.68	2.62	2.40	2.82	3.75	3.55	4.45
25.....	5.5	3.22	2.65	2.78	2.40	2.72	3.44	3.5	4.05
26.....	5.6	3.09	2.65	2.68	2.42	2.64	3.29	3.5	3.8
27.....	5.5	2.92	3.95	2.62	2.42	2.64	3.14	3.45	3.9
28.....	5.4	2.84	5.4	2.55	2.58	2.76	3.14	3.48	4.0
29.....	5.5	2.79	4.0	2.55	3.10	2.86	3.14	4.55	3.48
30.....	5.4	2.72	3.65	2.50	2.95	2.84	3.04	4.35	3.40
31.....	.....	2.69	.....	2.50	2.78	.....	3.09	.....	3.42

NOTE.— There was probably ice at this station from January 1 to about April 2.

*Daily discharge, in second-feet, of Salmon River at Fox's Bridge, near Pulaski, N. Y., for 1910.*

DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	DAY.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	.....	118	666	145	400	465	17.....	200	260	172	160	626	.....
2.....	.....	118	775	145	400	452	18.....	191	235	118	152	572	.....
3.....	.....	160	413	118	865	400	19.....	118	521	118	152	521	.....
4.....	.....	145	912	112	732	400	20.....	112	595	152	152	500	.....
5.....	.....	275	690	296	690	352	21.....	125	329	118	135	400	.....
6.....	.....	690	865	1,230	626	285	22.....	118	200	135	135	535	.....
7.....	.....	1,060	884	1,290	690	285	23.....	160	213	103	183	521	.....
8.....	.....	432	504	820	595	285	24.....	172	152	118	340	572	.....
9.....	.....	285	370	465	595	.....	25.....	135	152	172	329	690	.....
10.....	.....	296	340	413	820	.....	26.....	135	213	152	912	674	.....
11.....	.....	1,010	191	340	2,290	.....	27.....	118	285	183	758	595	.....
12.....	.....	793	226	1,040	1,540	.....	28.....	152	245	160	707	535	.....
13.....	.....	572	152	226	1,190	.....	29.....	135	160	160	707	521	.....
14.....	.....	226	260	160	191	912	30.....	118	118	183	595	521	.....
15.....	.....	135	200	191	191	775	31.....	152	172	.....	479	.....	.....
16.....	.....	145	160	152	183	707	.....	.....	.....	.....	.....	.....	.....

NOTE.— Daily discharge determined from a fairly well-defined discharge rating curve. The computations have been revised and supersede those previously published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.



*Daily discharge, in second-feet, of Salmon River at Pulaski, N. Y., for 1911.*

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1,800	3,710	376	432	103	191	255	820	1,230
2.....	1,500	5,050	528	312	103	172	307	682	1,010
3.....	1,230	2,970	352	235	88	152	364	507	732
4.....	950	1,610	265	200	103	152	458	439	550
5.....	1,230	1,230	820	160	88	118	1,290	413	610
6.....	2,370	1,010	2,130	152	88	1,410	1,010	364	610
7.....	4,850	1,010	1,060	152	88	1,230	1,290	1,060	535
8.....	4,850	912	912	135	112	610	1,120	1,680	535
9.....	4,090	865	493	118	162	479	642	1,120	775
10.....	3,710	775	394	118	213	452	528	775	2,130
11.....	3,520	658	307	118	152	312	426	820	2,620
12.....	3,900	580	820	172	145	285	364	707	4,470
13.....	4,280	493	1,010	152	118	285	318	2,450	6,450
14.....	5,450	426	690	125	103	260	265	1,610	3,900
15.....	6,660	394	458	112	103	235	245	1,230	2,060
16.....	5,050	364	376	118	118	312	209	960	1,760
17.....	3,330	352	318	370	112	285	217	565	2,540
18.....	2,970	318	255	1,170	103	231	550	1,230	1,830
19.....	3,150	318	231	550	125	175	1,230	1,680	1,230
20.....	3,710	458	209	285	103	160	820	1,350	690
21.....	4,090	394	168	235	94	149	626	1,170	674
22.....	3,150	318	187	191	88	231	602	912	775
23.....	2,540	296	209	152	88	307	775	732	1,610
24.....	2,210	439	183	160	88	245	912	732	1,760
25.....	3,520	479	172	226	88	200	642	690	1,230
26.....	3,710	394	172	183	94	168	528	690	960
27.....	3,520	296	1,120	160	94	168	426	650	1,060
28.....	3,330	255	3,330	135	145	217	426	674	1,170
29.....	3,520	231	1,170	135	400	265	426	1,900	674
30.....	3,330	200	820	118	312	255	364	1,610	610
31.....	.....	187	.....	118	226	.....	394	.....	626

NOTE.—Daily discharge is based on a well-defined discharge rating curve. Discharge April 1 and 2, estimated.

*Monthly discharge of Salmon River at Fox's Bridge near Pulaski, N. Y., for 1910.*  
[Drainage area, 264 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
July 14-31.....	226	112	147	.555	.37	B
August.....	1,060	118	336	1.27	1.46	B
September.....	912	103	318	1.20	1.34	B
October.....	1,040	112	423	1.60	1.84	B
November.....	2,290	400	720	2.73	3.05	B
December.....	.....	.....	335	1.27	1.46	D

NOTE.—Discharge for the period during which ice existed, December 9 to 31, estimated by means of comparisons with the run-off from adjacent drainages.

Mean discharge December 9 to 31, estimated 337 second-feet.

The computations have been revised and supersede data contained in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the State Engineer and Surveyor, State of New York.

*Monthly discharge of Salmon River at Pulaski, N. Y., for 1911.*  
 [Drainage area, 264 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
April.....	6,660	950	3,380	12.8	14.28	A
May.....	6,050	187	871	3.30	3.80	A
June.....	3,330	168	651	2.47	2.76	A
July.....	1,170	112	226	.856	.99	A
August.....	400	88	131	.496	.57	A
September.....	1,410	118	324	1.23	1.37	A
October.....	1,290	209	582	2.20	2.54	B
November.....	2,450	364	1,010	3.83	4.27	A
December.....	6,450	535	1,530	5.80	6.69	A

*Orwell Brook near Altmar, N. Y.*

*Location.*—At highway bridge  $1\frac{1}{2}$  miles by road northwest of Altmar and one-eighth mile above confluence of Orwell Brook with Salmon River.

*Records available.*—June 23 to December 31, 1911. Data also in annual reports of United States Geological Survey.

*Drainage area.*—22.1 square miles.

*Gage.*—Standard chain, attached to downstream side of bridge.

*Channel.*—Curved above the bridge and current rather swift. Bed composed of small stone and gravel; two channels above bridge, but one at gage.

*Discharge measurements.*—Made by wading at low stages, from bridge at high stages.

*Winter flow.*—No information; relation of gage height to discharge probably affected by ice.

*Accuracy.*—The discharge rating curve has been fairly well developed for low stages.

*Co-operation.*—Established by United States Geological Survey in co-operation with the Ontario Power Company of Niagara Falls and State of New York Conservation Commission.

*Discharge measurements of Orwell Brook near Altmar, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Mar. 22.....	C. S. De Golyer.....	19	22.8	b 1.98	19.9
June 23 a.....	C. S. De Golyer.....	22	19.7	1.92	13.8
Sept. 14 a.....	G. H. Canfield.....	19	14.6	2.00	17.6
Sept. 14 a.....	G. H. Canfield.....	19	15.0	2.01	18.2
Sept. 17 a.....	G. H. Canfield.....	21	13.4	1.97	15.2
Nov. 14 c.....	C. S. De Golyer.....	32	48.4	2.83	94.9
Dec. 12.....	C. S. De Golyer.....	24	63.6	3.64	220

a Measurement made by wading a short distance below bridge.

b Measurement made before gage was established; gage height uncertain.

c Made by wading 200 feet below bridge.

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*Daily gage height, in feet, of Orwell Brook near Altmar, N. Y., for 1911.*  
[Mrs. A. G. White, observer.]

DAY.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		2.22	1.70	1.85	1.98	2.28	2.78
2.		2.12	1.70	1.80	2.08	2.22	2.49
3.		2.08	1.70	1.78	2.00	2.20	2.48
4.		2.00	1.70	1.72	2.30	2.15	2.42
5.		1.95	1.70	1.65	2.30	2.10	2.45
6.		1.90	1.65	2.80	2.28	2.05	2.34
7.		1.88	1.65	2.32	2.55	2.45	2.28
8.		1.85	1.88	2.15	2.35	2.48	2.26
9.		1.85	2.02	2.18	2.22	2.38	2.90
10.		1.80	1.85	2.05	2.12	2.35	3.1
11.		1.80	1.80	1.98	2.08	2.30	3.4
12.		1.82	1.75	2.00	2.02	2.48	3.65
13.		1.80	1.70	1.98	2.02	2.98	4.2
14.		1.75	1.65	1.92	2.00	2.86	3.2
15.		1.80	1.68	1.95	1.95	2.60	2.88
16.		1.75	1.75	1.92	1.95	2.49	2.80
17.		2.45	1.75	1.92	1.95	3.55	2.98
18.		2.62	1.75	1.95	2.40	2.88	2.75
19.		2.28	1.80	1.90	2.38	2.82	2.52
20.		2.08	1.75	1.92	2.22	2.72	2.60
21.		1.95	1.70	1.85	2.18	2.61	2.52
22.		1.90	1.65	2.12	2.10	2.50	2.35
23.	1.95	1.82	1.65	2.02	2.32	2.50	2.85
24.	1.78	1.98	1.65	1.95	2.28	2.45	2.62
25.	1.75	1.82	1.70	1.90	2.20	2.38	2.50
26.	1.75	1.82	1.75	1.90	2.12	2.40	2.45
27.	3.5	1.80	1.70	1.88	2.15	2.40	2.62
28.	4.6	1.78	1.85	2.02	2.18	2.48	2.28
29.	2.90	1.75	2.02	1.98	2.10	3.2	2.48
30.	2.40	1.75	1.82	2.00	2.05	2.80	2.52
31.		1.75	1.75		2.18		2.45

*Daily discharge, in second-feet, of Orwell Brook near Altmar, N. Y., for 1911.*

DAY.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		32	6	11	16	36	92
2.		24	6	9	22	32	57
3.		22	6	8	17	30	56
4.		17	6	7	38	26	50
5.		15	6	5	38	23	53
6.		13	5	95	36	20	42
7.		12	5	40	64	53	36
8.		11	12	26	43	56	35
9.		11	18	28	32	46	109
10.		9	11	20	24	43	139
11.		9	9	16	22	38	186
12.		10	8	17	18	56	229
13.		9	6	16	18	121	330
14.		8	5	14	17	103	154
15.		9	6	15	15	70	106
16.		8	8	14	15	57	95
17.		53	8	14	15	212	121
18.		72	8	15	48	106	88
19.		36	9	13	46	98	60
20.		22	8	14	32	85	70
21.		15	6	11	29	71	60
22.		13	5	24	23	58	43
23.	15	10	5	18	40	58	102
24.	8	16	5	15	36	53	72
25.	8	10	6	13	30	46	58
26.	8	10	8	13	24	48	53
27.	203	9	6	12	26	48	72
28.	410	8	11	18	29	56	36
29.	109	8	18	16	23	154	56
30.	48	8	10	17	20	95	60
31.		8	8		26		53

NOTE.—Daily discharge determined from a discharge rating curve well defined between 10 and 300 second-feet.

*Monthly discharge of Orwell Brook near Altmar, N. Y., or 1911.*  
 [Drainage area, 22.1 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
June 23-30.....	410	8	101.	4.57	1.36	B
July.....	72	8	16.7	.756	.87	B
August.....	18	5	7.87	.356	.41	C
September.....	95	5	18.5	.837	.93	B
October.....	64	15	28.5	1.29	1.49	A
November.....	154	20	66.6	3.01	3.36	A
December.....	330	35	89.5	4.05	4.67	A

#### BLACK RIVER DRAINAGE BASIN.

##### *Description.*

Black river rises in the western part of Hamilton county, N. Y., flows southwestward across Herkimer county into Oneida county, turns near Forestport and runs somewhat west of north through Lewis county to eastern Jefferson county, and then flows westward to Black River bay, at the eastern extremity of Lake Ontario. Its total drainage area is 1,930 square miles. The upper part of the basin is very rugged and mountainous, contains a large number of lakes, and is in a part of the Adirondack forest.

The mean annual precipitation is about 40 inches, ranging from 55 inches in the extreme headwaters to perhaps 30 inches near Lake Erie. The winters are generally quite severe, and the stream flow is affected by ice for periods of several months.

The regimen of the river is controlled by storage on its upper tributaries (including Beaver river at Beaver), a series of reservoirs at the headwaters of Moose river, and additional reservoirs at Forestport and on the headwaters of the main river.

Water is diverted from Black river through Forestport feeder to supply the Black River canal at Boonville. A portion of this diverted water flows northward from Boonville and enters Black river again at Lyons Falls; the remainder flows southward through the Black River canal and enters the Erie canal at Rome.

##### *Black River near Boonville, N. Y.*

*Location.*—At highway bridge about 2 or 3 miles northeast of Boonville, an equal distance by river downstream from Hawkinsville, and about 1 mile above the mouth of Sugar River, a small tributary from the left.

*Records available.*—February 16 to December 31, 1911; data also in annual reports of the United States Geological Survey.

*Drainage area.*—316 square miles.

*Gage.*—Standard chain, fastened to the downstream side of the bridge. A staff gage, reading from 6 to 13 feet, is fastened to the downstream right-hand abutment and is used for high water readings.

*Channel.*—Rough and bouldery; permanent.

*Discharge measurements.*—At high stages from a cable stretched across the stream about one-quarter mile above the gage; at low stages, by wading near the cable section.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—A well-defined discharge rating curve has been developed. The records do not give the total discharge of the drainage area. See Diversions.

*Diversions.*—A portion of the flow of Black River is diverted past the gaging station through a feeder having its intake at the State dam at Forestport and delivering its flow to the summit level of Black River canal at Boonville. A portion of the flow passes northward, supplying the Black River canal from Boonville to the head of slack water navigation at the foot of Lyons Falls. The remainder is diverted from the drainage basin and flows into the Erie canal at Rome. To determine the amount diverted past the station and out of the drainage basin measurements are made in the Forestport feeder at a farm bridge near Speny Hill, one mile northeast of Boonville. Measurements of northward flow in Black River canal are made at a farm bridge one-half mile north of Boonville; measurements of the southward flow at a farm bridge about three-fourths mile southeast from Boonville. Results of measurements made at this place in the past are published in reports of the State Engineer and Surveyor of New York.

*Storage.*—Reservoirs built by the State at Forestport, about 8 miles upstream, store about 2,000,000,000 cubic feet. About a mile above the station is a site at which a dam 110 feet high would impound 3.3 billion cubic feet of water.

*Co-operation.*—Established and maintained in co-operation with the United States Geological Survey.

*Discharge measurements of Black River near Boonville, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 16 a. ....	Hoyt and Shuttleworth. ....	47	150	4.99	307
April 22 b. ....	C. C. Covert. ....	143	521	7.60	2,410
June 30 c. ....	C. S. De Golyer. ....	82	148	3.75	107
Aug. 20 c. ....	C. C. Covert. ....	49	51	3.40	59.1
Sept. 13 d. ....	G. H. Canfield. ....	101	276	4.55	268
Sept. 13 c. ....	G. H. Canfield. ....	98	247	4.50	244
Nov. 23. ....	C. S. De Golyer. ....	111	393	5.97	912
Nov. 23. ....	C. S. De Golyer. ....	112	384	6.00	891
Dec. 13. ....	C. S. De Golyer. ....	171	742	8.43	3,790

a Measurement made under complete ice cover, about one-half mile above bridge and gage average thickness of ice 1.56 feet.

b Measurement made from bridge on which gage is fastened; poor section in high water.

c Measurement made by wading about 200 feet above bridge.

d Wading at cable section.

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Daily gage height, in feet, of Black River at Boonville, N. Y., for 1911.

[W. D. Charboneau, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		5.2	6.5	8.2	5.4	3.40	3.22	3.58	3.48	5.0	6.5
2.....		5.1	6.0	8.8	6.1	3.36	3.19	3.52	3.50	5.1	5.9
3.....		5.1	5.85	9.0	5.2	3.36	3.19	3.76	3.45	4.95	5.8
4.....		5.2	5.69	7.8	4.7	3.50	3.21	4.6	3.75	4.7	5.5
5.....		5.05	5.8	7.2	5.05	3.38	3.22	4.6	4.8	4.38	5.4
6.....		5.0	6.4	7.0	6.6	3.22	3.50	4.65	4.95	4.35	5.4
7.....		4.55	7.6	6.6	6.2	3.31	3.78	5.2	5.9	4.9	5.3
8.....		4.08	7.6	6.4	5.45	3.25	3.84	4.9	5.85	5.9	5.25
9.....		4.55	7.6	6.1	5.1	3.24	3.82	4.9	5.4	6.1	5.4
10.....		4.55	7.3	5.85	4.8	3.26	3.55	5.0	4.65	5.6	5.9
11.....		5.15	7.1	5.65	4.6	3.28	3.31	5.0	3.95	5.4	6.3
12.....		5.05	7.2	5.45	6.0	3.24	3.36	4.48	3.88	5.7	6.9
13.....		5.0	7.4	5.4	7.0	3.28	3.32	4.5	3.82	6.0	8.5
14.....		4.95	7.9	5.0	7.0	3.29	3.32	4.20	3.77	6.1	8.3
15.....		5.0	8.8	4.8	6.4	3.31	3.30	3.68	3.68	5.7	7.3
16.....	4.99	4.65	8.9	4.8	5.9	3.71	3.38	3.45	3.58	5.5	6.8
17.....	5.0	5.05	8.0	4.7	5.8	4.10	3.45	3.85	3.50	5.15	7.0
18.....	5.3	5.0	7.2	4.6	5.45	4.38	3.35	3.68	3.98	5.8	7.0
19.....	5.45	4.8	7.2	4.9	5.0	3.78	3.38	3.70	5.3	6.7	6.6
20.....	5.3	4.9	7.2	5.0	4.6	3.35	3.35	3.42	5.3	6.8	5.9
21.....	5.2	4.9	7.3	5.0	4.38	3.31	3.36	3.35	4.95	6.5	5.7
22.....	5.15	5.05	7.5	4.8	4.20	3.27	3.26	3.48	5.0	6.1	5.8
23.....	5.05	5.25	7.3	4.85	4.18	3.32	3.34	3.58	5.7	5.75	6.1
24.....	5.0	5.3	6.9	5.2	3.88	3.48	3.25	3.52	5.5	5.9	7.6
25.....	5.0	5.25	7.5	5.9	3.72	3.45	3.19	3.58	5.6	5.75	6.6
26.....	5.0	5.1	7.9	5.75	3.62	3.35	3.12	3.42	5.25	5.6	6.4
27.....	5.3	6.4	7.6	5.45	3.68	3.30	3.18	3.32	5.05	5.6	6.3
28.....	5.2	8.3	7.6	5.5	3.93	3.32	3.65	3.38	5.15	5.5	6.4
29.....		7.4	8.0	4.75	3.75	3.24	5.2	3.32	5.15	6.4	6.2
30.....		7.3	8.2	4.55	3.70	3.24	4.10	3.38	4.9	6.8	5.9
31.....		6.9		4.35		3.22	3.80		4.7		5.95

NOTE.—Relation of gage height to discharge affected by backwater from ice from about January 1 to about March 27. Probably no backwater from ice during December. Gage heights were probably taken to the water surface.

Canal feeder closed November 20.

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for 1911.

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1,320	3,480	590	61	44	82	70	410	1,320
2.....		950	4,560	1,020	57	41	74	72	450	880
3.....		848	4,960	495	57	41	106	66	390	815
4.....		749	2,850	305	72	43	275	104	305	640
5.....		815	2,040	430	59	44	275	335	224	590
6.....		1,240	1,810	1,410	44	72	290	390	218	590
7.....		2,560	1,410	1,090	52	109	495	880	370	540
8.....		2,560	1,240	615	46	119	370	848	880	518
9.....		2,560	1,020	450	46	115	370	590	1,020	590
10.....		2,160	848	335	47	78	410	390	695	880
11.....		1,920	725	275	49	52	410	138	590	1,160
12.....		2,040	615	950	46	57	246	126	755	1,700
13.....		2,290	590	1,810	49	53	250	115	950	4,000
14.....		3,000	410	1,810	50	53	186	108	1,020	3,650
15.....		4,560	335	1,240	52	51	94	94	755	2,160
16.....		4,760	335	880	98	59	66	82	640	1,600
17.....		3,160	305	815	166	66	120	72	472	1,810
18.....		2,040	275	615	224	56	94	143	815	1,810
19.....		2,040	370	410	109	59	97	540	1,500	1,410
20.....		2,040	410	275	56	56	63	540	1,600	880
21.....		2,160	410	224	52	57	56	390	1,320	755
22.....		2,420	335	186	48	47	70	410	1,020	815
23.....		2,160	352	182	53	55	82	755	785	1,020
24.....		1,700	495	126	70	46	74	640	880	2,560
25.....		2,420	880	100	66	41	82	695	785	1,410
26.....		3,000	785	87	56	36	63	518	695	1,240
27.....	1,240	2,560	615	94	51	40	53	430	695	1,160
28.....	3,650	2,560	640	134	53	90	59	472	640	1,240
29.....	2,290	3,160	320	104	46	495	53	472	1,240	1,090
30.....	2,160	3,480	262	97	46	166	59	370	1,600	915
31.....	1,700		218		44	112		305		880

NOTE.—Daily discharge determined from a well-defined discharge rating curve.

Monthly discharge of Black River near Boonville, N. Y., for 1911.  
[Drainage area, 316 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....			375	1.19	1.37	C
February.....			275	1.870	.91	C
March.....	3,650		608	1.92	2.21	B
April.....	4,760	749	2,310	7.31	8.16	A
May.....	4,960	218	1,090	3.45	3.98	A
June.....	1,810	87	572	1.81	2.02	A
July.....	224	44	65.3	.207	.24	A
August.....	495	36	79.1	.250	.29	A
September.....	495	53	167	.528	.59	A
October.....	880	66	360	1.14	1.31	A
November.....	1,600	218	791	2.50	2.79	A
December.....	4,000	518	1,310	4.15	4.78	A
The year.....	4,960	36	667	2.11	28.65	

NOTE.—Discharge January 1 to March 26, estimated from that of Black River at Felts Mills, the rate of run-off at Booneville being considered slightly less than at Felts Mills during this period. Mean discharge March 1 to 26, estimated 300 second-feet.

#### Moose River at Moose River, N. Y.

*Location.*—In the village of Moose river, about three miles down stream from McKeever station on the Adirondack division of the New York Central railroad, five miles below the mouth of south branch of Moose river (coming in from left) and nearly twenty miles above the junction of Black and Moose rivers at Lyons Falls.

*Records available.*—June 5, 1900, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Engineer and Surveyor and State Water Supply Commission of New York.

*Drainage area.*—Three hundred and forty-six square miles.

*Gage.*—Staff, in two sections, fastened to the left bank a short distance above cable; read twice daily. The elevation of the gage zero was changed February 28, 1903, from 15.36 to 15.53.

*Channel.*—Composed of cobble and boulders; fairly permanent; current smooth; depth comparatively uniform; just above the station is a small island upon which ice and log jams occasionally form. Velocity from dam at McKeever to the station relatively slow; below the station velocity very high.

*Discharge measurements.*—Made from cable erected July, 1903. Cable had a clear span of 269 feet.

*Artificial control.*—A timber dam at McKeever is used for power and for the regulation of flow for log driving. During portions of the year, therefore, two gage readings a day may not give a representative mean.

*Winter flow.*—The stream freezes over in winter and is covered with alternate layers of ice and snow which render the determination of discharge difficult.

*Accuracy.*—Discharge rating curve for open channel fairly accurate. Published discharge data for periods of open water considered good.

*Co-operation.*—The station was established and is maintained in co-operation with the New York State Engineer and Surveyor, and the United States Geological Survey.

*Discharge measurements of Moose River at Moose River, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. Ft.</i>	<i>Feet.</i>	<i>Sec.- Ft.</i>
April 29 a.....	W. G. Hoyt.....	246	1,760	6.54	4,700
July 15.....	C. S. De Golyer.....	213	440	1.04	293

a Measurement partly estimated by timing floating logs to obtain velocity. Area determined by separate soundings. Coefficient of .84 from vertical velocity curves taken in 1904.

*Daily gage height, in feet, of Moose River at Moose River, in 1911.*

[Chr's. Hannan, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.6			4.0	6.6	2.0	1.6	.8	.5	1.0	3.0	2.2
2.....	2.2				8.6	2.2	1.5	.8	.5	1.1	2.9	2.1
3.....	2.9				6.6	2.3	1.5	.75	.6	1.2	3.0	2.2
4.....	3.2	2.9	2.4		5.2	2.2	1.35	.7	.6	1.15	3.1	2.3
5.....	3.4				5.2	2.5	1.2	.6	.75	1.5	3.0	2.4
6.....	3.5				5.0	2.9	1.05	.5	.9	1.9	3.2	2.5
7.....	3.9				4.7	2.8	.9	.6	.9	2.0	3.6	2.6
8.....	4.2			4.5	4.2	2.6	.85	.6	.8	2.0	3.95	2.7
9.....	4.2				4.1	2.2	.7	.5	.8	2.1	3.9	3.1
10.....	2.2				4.0	2.0	1.05	.5	.8	2.2	3.8	3.6
11.....	1.8	2.9	2.6		3.4	1.9	1.1	.6	.9	1.9	3.7	4.4
12.....					3.0	2.0	1.1	.6	.9	1.8	3.6	5.2
13.....					2.7	2.0	1.1	.75	.9	1.8	3.3	7.0
14.....	2.3				2.6	1.8	1.1	.7	.8	1.9	3.0	5.5
15.....				6.4	2.6	1.8	1.2	.65	.9	1.9	2.6	4.3
16.....				5.9	2.4	1.7	.95	.6	1.0	1.8	2.1	4.0
17.....				4.6	2.3	1.6	1.2	.7	.9	2.0	1.8	3.8
18.....		2.6	2.6	3.7	2.2	1.6	1.55	.6	.8	2.2	1.6	3.8
19.....				3.2	2.0	1.6	1.65	.6	.7	2.4	1.6	3.6
20.....				3.1	2.0	1.7	1.3	.7	.7	2.8	1.6	3.4
21.....	2.3			3.5	2.2	1.6	1.15	.7	.8	3.0	1.5	3.3
22.....				3.9	2.2	1.5	1.0	.6	.9	3.0	1.5	3.4
23.....				3.6	2.6	1.6	1.1	.6	.9	3.1	1.4	3.6
24.....				3.8	2.2	1.6	1.0	.5	.8	3.0	1.5	3.8
25.....		2.6	2.4	4.0	2.2	1.5	1.1	.5	.7	3.0	1.6	4.4
26.....				5.0	2.3	1.6	1.0	.5	.8	3.1	1.5	4.0
27.....				5.8	2.4	1.6	.9	.6	.9	3.0	1.6	3.4
28.....	2.5			6.0	2.3	1.5	.85	.6	1.0	3.0	1.7	3.5
29.....				6.6	2.3	1.6	.7	.7	1.0	3.1	2.0	3.8
30.....				6.3	2.1	1.6	.7	.8	.9	3.0	2.2	3.5
31.....					2.2		.7	.6		3.1		3.1

NOTE.—Relation of gage height to discharge affected by ice January 1 to April 14. Probably not much back-water from ice during December. The gage readings were probably to water surface.



*Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for 1911.*

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4,780	610	465	240	175	290	1,150	700
2		7,200	700	435	240	175	315	1,080	650
3		4,780	750	435	228	195	345	1,150	700
4		3,140	700	390	215	195	330	1,220	750
5		3,140	855	345	195	228	435	1,150	800
6		2,920	1,080	312	175	265	570	1,290	855
7		2,600	1,020	265	195	265	610	1,590	910
8		2,120	910	252	195	240	610	1,900	965
9		2,030	700	215	175	240	650	1,850	1,220
10		1,940	610	302	175	240	700	1,760	1,590
11		1,430	570	315	195	265	570	1,670	2,300
12		1,150	610	315	195	265	535	1,590	3,140
13		965	610	315	228	265	535	1,360	5,260
14		910	535	315	215	240	570	1,150	3,470
15		910	535	345	205	265	570	910	2,210
16		3,940	800	500	278	195	535	650	1,940
17		2,500	750	465	345	215	610	535	1,760
18		1,670	700	465	450	195	700	465	1,760
19		1,290	610	465	482	195	800	465	1,590
20		1,220	610	500	375	215	1,020	465	1,430
21		1,510	700	465	330	215	240	1,150	1,360
22		1,850	700	435	290	195	265	1,150	1,430
23		1,590	910	465	315	195	265	1,220	1,590
24		1,760	700	465	290	175	240	1,150	1,760
25		1,940	700	435	315	175	215	1,150	2,300
26		2,920	750	465	290	175	240	1,220	1,940
27		3,820	800	465	265	195	265	1,150	1,430
28		4,060	750	435	252	195	290	1,150	500
29		4,780	750	465	215	215	290	1,220	610
30		4,420	650	465	215	240	265	1,150	700
31		700	.....	215	195	.....	1,220	.....	1,220

NOTE.—Daily discharge determined from a discharge rating curve well defined between 240 and 3,650 second-feet.

*Monthly discharge of Moose River at Moose River, N. Y., for 1910.*

[Drainage area, 346 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	600	1.73	1.99	D
February	.....	.....	500	1.45	1.51	D
March	6,060	910	3,030	8.76	10.10	C
April	4,660	800	1,940	5.61	6.26	B
May	2,290	135	1,160	3.35	3.86	B
June	1,720	135	814	2.35	2.62	A
July	345	135	258	.746	.86	A
August	2,040	90	679	1.96	2.26	A
September	1,180	215	410	1.18	1.32	A
October	1,220	90	681	1.97	2.27	A
November	938	375	.....	1.79	2.00	B
December	518	90	308	.890	1.03	D
The year	6,060	90	917	2.65	36.08	

NOTE.—Monthly discharge for January and February estimated at approximately 25 per cent of the discharge of Black River at Felts Mills. This ratio holds quite consistently for these two stations during the open-water period.

The determination of discharge for November, as published in the Sixth Annual Report of the New York State Water Supply Commission and in the 1910 report of the State Engineer and Surveyor of New York State was slightly in error and has been corrected in the above table.

*Monthly discharge of Moose River at Moose River, N. Y., for 1911.*  
 [Drainage area, 346 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....			600	1.73	1.99	C
February.....			400	1.16	1.21	C
March.....			700	2.02	2.33	B
April.....			2,630	7.60	8.48	B
May.....	4,780	610	1,660	4.80	5.53	B
June.....	1,080	435	592	1.71	1.91	B
July.....	482	215	321	.928	1.07	B
August.....	240	175	202	.584	.67	B
September.....	290	175	244	.705	.79	B
October.....	1,220	290	782	2.26	2.61	B
November.....	1,900	405	943	2.73	3.05	B
December.....	5,260	650	1,670	4.83	5.57	B
The year.....		175	897	2.59	35.21	

NOTE.— Discharge January 1 to April 14 estimated at approximately 25 per cent of the discharge of Black River at Felt's Mills.  
 Mean discharge April 1 to 14 estimated 2,500 second-feet.

*Middle Branch, Moose River, at Old Forge, N. Y.*

*Location.*—About 300 feet below the highway bridge in Old Forge and about 400 feet below the dam.

*Records available.*—November 9, 1911, to December 31, 1911. Data also in annual reports of the United States Geological Survey.

*Drainage area.*—51.5 square miles.

*Gage.*—Vertical staff, graduated to feet and tenths, reading from one foot to seven feet, spiked to birch tree on left bank of stream 300 feet below highway bridge.

*Channel.*—Fairly straight from dam to a point about 200 feet below the gage where the river turns abruptly to the right and flows over a rock reef which is the control point for the gage. Channel fairly uniform from dam to point of control. Right bank high and wooded, left bank from the highway bridge, past the hatchery to within about fifty feet of the gage, defined by a stone wall about three feet above ordinary low water.

*Winter flow.*—No information available.

*Accuracy.*—Station rated from ordinary low water to ordinary high water, the rating table covering a gage height ranging from 1.60 feet to 3.00 feet, inclusive. Conditions at the station considered good.

*Co-operation.*—Established by the United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Middle Branch, Moose River, at Old Forge, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Aug. 21 a.....	C. C. Covert.....	58	93.2	1.96	79.3
Nov. 8 a.....	C. S. De Golyer.....	57	77.7	1.73	51.3
Nov. 8 a.....	C. S. De Golyer.....	57	104	2.16	106
Nov. 8 a.....	C. S. De Golyer.....	57	120	2.44	144
Nov. 9 a.....	C. S. De Golyer.....	58	151	2.90	231

a Measurement made by wading in front of State hatchery 150 feet above the gage.

*Daily gage height, in feet, of Middle Branch, Moose River, at Old Forge, for 1911.*

[Vernon S. Ervin, observer.]

DAY.	Nov.	Dec.	DAY.	Nov.	Dec.
1.....		2.55	17.....	2.70	3.00
2.....		2.55	18.....	2.65	3.00
3.....		2.50	19.....	2.65	3.00
4.....		2.50	20.....	2.65	3.00
5.....		2.50	21.....	2.65	2.95
6.....		2.45	22.....	2.60	2.90
7.....		2.45	23.....	2.60	2.90
8.....		2.45	24.....	2.60	2.95
9.....		2.45	25.....	2.60	2.95
10.....	2.30	2.45	26.....	2.60	2.95
11.....	2.35	2.45	27.....	2.55	2.90
12.....	2.35	2.42	28.....	2.55	2.85
13.....	2.40	2.60	29.....	2.50	2.80
14.....	2.70	2.80	30.....	2.55	2.80
15.....	2.70	2.95	31.....		2.75
16.....	2.70	3.00			

*Daily discharge, in second-feet, of Middle Branch, Moose River, at Old Forge, for 1911.*

DAY.	Nov.	Dec.	DAY.	Nov.	Dec.
1.....		172	17.....	201	262
2.....		172	18.....	192	262
3.....		163	19.....	192	262
4.....		163	20.....	192	262
5.....		163	21.....	192	252
6.....		154	22.....	182	241
7.....		154	23.....	182	241
8.....		154	24.....	182	252
9.....	128	154	25.....	182	252
10.....	136	154	26.....	182	252
11.....	136	154	27.....	172	241
12.....	136	149	28.....	172	231
13.....	145	182	29.....	163	221
14.....	201	221	30.....	172	221
15.....	219	252	31.....		211
16.....	201	262			

NOTE.— Daily discharge determined from a well-defined discharge rating curve.

*Monthly discharge of Middle Branch of Moose River at Old Forge, N. Y., for 1911.*  
 [Drainage area, 51.5 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
November 9-30.....	219	128	175	3.40	2.78	A
December.....	262	149	209	4.06	4.68	A

#### ST. LAWRENCE RIVER DRAINAGE BASIN.

##### *General Features.*

St. Lawrence river, the outlet of the Great Lakes system, receives also the flow of a number of New York streams having their sources in the north-erly slopes of the Adirondacks and fed by the innumerable lakes with which the region is dotted. Some of these rivers, as the Grass, Raquette, and St. Regis, lie entirely within the United States; others, notably Salmon, Trout, Chateaugay, and English rivers, cross the international boundary and flow northward into the St. Lawrence in Canada, as does also Richelieu river, the outlet of Lake Champlain. The following tables gives a list of the principal tributaries of the St. Lawrence in the United States, with the areas drained by them:

*Drainage areas of St. Lawrence River tributaries in the United States.*

	Square miles.		Square miles.
Oswegatchie River.....	1,609	Salmon River <i>a</i> .....	273
Grass River.....	637	Trout River <i>b</i> .....	129
Raquette River.....	1,219	Chateaugay River <i>b</i> .....	199
St. Regis River.....	910	English River <i>b</i> .....	53
Little Salmon River <i>a</i> .....	103	Lake Champlain <i>b</i> .....	8,187

*a* Above junction near international boundary.

*b* Above New York state line.

The St. Lawrence drains, through Lake Champlain, an area of about 4,560 square miles in the State of Vermont. This drainage is practically all from Mississippi, Lamoille, and Winooski rivers and Otter creek. Clyde, Barton, and Black rivers, in northern Vermont, are tributary to St. Lawrence river through Lake Memphremagog and St. Francis river.

##### *Oswegatchie River near Ogdensburg, N. Y.*

*Location.*—At the steel highway bridge known locally at Eel Weir bridge, about one mile below the mouth of the outlet of Black Lake and 5½ miles above the city of Ogdensburg and the mouth of the river.

*Records available.*—April 22, 1903, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—One thousand five hundred and eighty square miles.

*Gage.*—Chain, fastened to the upstream side of the bridge; read once daily; datum unchanged.

*Channel.*—Rocky and partly artificial, the rock having been removed underneath the bridge by blasting to increase the bridge opening.

*Discharge measurements.*—Usually made from the bridge.

*Artificial control.*—Three dams in the vicinity of the gage; one at Heuvelton, about five miles above; one at Rensselaer Falls, ten miles above, and one at Ogdensburg.

*Winter flow.*—Not affected by ice, as velocity of the current at the station is swift.

*Accuracy.*—Rating curve fairly well developed; open-water curve used throughout the year.

*Co-operation.*—Established by the United States Geological Survey in co-operation with the State Engineer and Surveyor, of New York.

*Discharge measurements of Oswegatchie River near Ogdensburg, N. Y. in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 18.....	F. J. Shuttleworth.....	134	324	5.05	1,290
July 1 a.....	G. H. Canfield.....	230	443	5.22	1,030

a Measurement made from up stream side of bridge where measuring conditions are poor.

*Daily gage height, in feet, of Oswegatchie River near Ogdensburg, N. Y., for 1911.*

[Joseph H. La Rue, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.2	5.7	5.2	8.6	6.3	6.1	5.1	4.5	4.4	4.7	4.9	6.5
2.....	5.2	5.7	5.2	8.3	6.4	6.0	5.1	4.5	4.4	4.6	4.9	6.5
3.....	5.3	5.7	5.4	8.1	6.3	5.8	5.1	4.5	4.4	4.6	5.0	6.5
4.....	5.9	5.7	5.5	8.0	6.4	5.7	5.1	4.5	4.4	4.6	5.0	6.5
5.....	6.1	5.7	5.4	7.7	6.4	5.7	5.0	4.5	4.4	4.6	5.1	6.4
6.....	6.5	5.6	5.4	7.8	6.4	5.7	5.0	4.5	4.5	4.7	5.0	6.3
7.....	6.6	5.6	5.4	8.1	6.4	5.5	4.9	4.5	4.5	4.9	5.1	6.2
8.....	6.2	5.5	5.3	8.5	6.3	5.6	4.9	4.5	4.6	5.0	5.3	6.2
9.....	6.4	5.5	5.2	9.1	6.3	5.6	4.9	4.5	4.8	5.0	5.3	6.1
10.....	6.1	5.5	5.2	9.4	6.1	5.6	4.9	4.4	4.9	5.0	5.5	6.0
11.....	6.2	5.4	5.1	9.5	5.9	5.7	4.9	4.5	4.9	5.1	5.5	6.0
12.....	6.1	5.3	5.1	9.4	5.9	5.7	4.8	4.5	4.9	5.1	5.9	6.2
13.....	6.1	5.2	5.1	9.1	5.8	5.6	4.8	4.5	4.9	5.1	5.7	6.2
14.....	6.1	5.2	5.1	9.1	5.7	5.5	4.7	4.4	4.9	5.1	5.7	6.6
15.....	6.1	5.2	5.5	9.1	5.5	5.5	4.7	4.4	5.0	5.1	5.7	7.0
16.....	6.1	5.1	6.2	9.0	5.4	5.4	4.7	4.4	5.0	5.1	5.7	7.4
17.....	6.1	5.1	6.6	8.9	5.4	5.3	4.7	4.4	4.9	5.1	5.7	7.4
18.....	6.0	5.0	6.1	8.5	5.4	5.3	4.7	4.4	4.9	5.1	5.7	7.5
19.....	6.0	5.0	6.1	8.4	5.4	5.4	4.7	4.4	4.9	5.1	6.0	7.4
20.....	5.9	5.1	6.0	8.1	5.4	5.3	4.7	4.4	4.9	5.1	6.0	7.2
21.....	5.8	5.1	6.0	8.1	5.5	5.3	4.7	4.4	4.9	5.0	6.1	7.2
22.....	5.7	5.1	6.0	8.0	5.6	5.3	4.7	4.4	4.9	5.0	6.1	7.2
23.....	5.7	5.1	6.1	7.7	5.8	5.3	4.7	4.4	4.9	5.0	6.1	7.0
24.....	5.7	5.1	6.3	7.5	6.0	5.2	4.7	4.4	4.8	5.0	6.1	6.9
25.....	5.6	5.1	6.1	7.3	6.0	5.2	5.0	4.4	4.8	5.0	6.2	6.9
26.....	5.5	5.1	6.0	7.0	6.2	5.2	4.6	4.4	4.8	5.0	6.0	6.7
27.....	5.5	5.1	6.3	6.7	6.3	5.2	4.6	4.4	4.8	5.0	6.0	6.6
28.....	5.5	5.1	7.3	6.6	6.3	5.2	4.5	4.4	4.7	5.0	6.1	6.4
29.....	5.3	.....	7.8	6.5	6.4	5.1	4.5	4.4	4.7	5.0	6.2	6.4
30.....	5.3	.....	8.5	6.3	6.3	5.1	4.5	4.4	4.7	4.9	6.3	6.7
31.....	5.7	.....	8.6	.....	6.2	.....	4.5	4.4	.....	4.9	.....	6.5

NOTE.—Relation of gage height to discharge at this station not affected by ice.

*Daily discharge, in second-feet, of Oswegatchie River, near Ogdensburg, N. Y., for 1911.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1,570	2,640	1,570	11,200	4,310	3,730	1,380	450	330	720	1,030	4,890
2.....	1,570	2,640	1,570	10,300	4,600	3,440	1,380	450	330	580	1,030	4,890
3.....	1,770	2,640	1,970	9,660	4,310	2,890	1,380	450	330	580	1,200	4,890
4.....	3,160	2,640	2,180	9,350	4,600	2,640	1,380	450	330	580	1,200	4,890
5.....	3,730	2,640	1,970	8,450	4,600	2,640	1,200	450	330	580	1,380	4,600
6.....	4,890	2,400	1,970	8,750	4,600	2,640	1,200	450	450	720	1,200	4,310
7.....	5,180	2,400	1,970	9,660	4,600	2,180	1,030	450	450	1,030	1,380	4,120
8.....	4,020	2,180	1,770	10,900	4,310	2,400	1,030	450	580	1,200	1,770	4,020
9.....	4,600	2,180	1,570	12,700	4,310	2,410	1,030	450	870	1,200	1,770	3,730
10.....	4,020	2,180	1,570	13,660	3,730	2,400	1,030	330	1,030	1,200	2,180	3,440
11.....	4,020	1,970	1,380	14,000	3,160	2,640	1,030	450	1,030	1,380	2,180	3,440
12.....	3,730	1,770	1,380	13,600	3,160	2,640	870	450	1,030	1,380	3,160	4,020
13.....	3,730	1,570	1,380	12,700	2,890	2,400	870	450	1,030	1,380	2,640	4,020
14.....	3,730	1,570	1,380	12,700	2,640	2,180	720	330	1,030	1,380	2,640	5,180
15.....	3,730	1,570	2,180	12,700	2,180	2,180	720	330	1,200	1,380	2,640	6,360
16.....	3,730	1,380	4,020	12,400	1,970	1,970	720	330	1,200	1,380	2,640	7,550
17.....	3,730	1,380	5,180	12,110	1,970	1,770	720	330	1,030	1,380	2,640	7,550
18.....	3,440	1,200	3,730	10,900	1,970	1,770	720	330	1,030	1,380	2,640	7,850
19.....	3,440	1,200	3,730	10,600	1,970	1,970	720	330	1,030	1,380	3,440	7,550
20.....	3,160	1,380	3,440	9,660	1,970	1,770	720	330	1,030	1,380	3,440	6,960
21.....	2,890	1,380	3,440	9,660	2,180	1,770	720	330	1,030	1,200	3,730	6,960
22.....	2,640	1,380	3,440	9,350	2,400	1,770	720	330	1,030	1,200	3,730	6,960
23.....	2,640	1,380	3,730	8,450	2,890	1,770	720	330	1,030	1,200	3,730	6,360
24.....	2,640	1,380	4,310	7,850	3,440	1,570	720	330	870	1,200	3,730	6,070
25.....	2,400	1,380	3,730	7,250	3,440	1,570	1,200	330	870	1,200	4,020	6,070
26.....	2,180	1,380	3,440	6,360	4,020	1,570	580	330	870	1,200	3,440	5,480
27.....	2,180	1,380	4,310	5,480	4,310	1,570	580	330	870	1,200	3,440	5,180
28.....	2,180	1,380	7,250	5,180	4,310	1,570	450	330	720	1,200	3,730	4,600
29.....	1,770	.....	8,750	4,890	4,600	1,380	450	330	720	1,200	4,020	4,600
30.....	1,770	.....	10,900	4,310	4,310	1,380	450	330	720	1,030	4,310	5,480
31.....	2,640	.....	11,200	.....	4,020	.....	450	330	.....	1,030	.....	4,890

NOTE.—Daily discharge determined from a fairly well-defined discharge rating curve.

*Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for 1911.*

[Drainage area, 1,580 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Accuracy.
January.....	5,180	1,570	3,120	2.97	3.42	B
February.....	2,640	1,200	1,810	1.15	1.20	B
March.....	11,200	1,380	3,560	2.25	2.59	A
April.....	14,000	4,310	9,820	6.22	6.94	A
May.....	4,600	1,970	3,480	2.20	2.54	A
June.....	3,730	1,380	2,150	1.36	1.52	A
July.....	1,380	450	867	.549	.63	B
August.....	450	330	376	.238	.27	B
September.....	1,200	330	813	.515	.57	B
October.....	1,380	580	1,130	.715	.82	B
November.....	4,310	1,030	2,670	1.69	1.89	A
December.....	7,850	3,440	5,380	3.41	3.93	A
The year.....	14,000	330	2,930	1.85	26.32	

## RAQUETTE RIVER DRAINAGE BASIN.

*Description.*

Raquette river rises in northern Hamilton county, flows practically north through a long narrow valley to St. Lawrence river. It has a total length of 162 miles, from its source to its confluence with the St. Lawrence, near the most northern point of the State.

Its source is on an elevated plateau of some 1,600 feet above sea level. The upper water-shed includes many acres of swamp land, as well as a large area of lakes and ponds, including Tupper lake, Little Tupper lake, Long lake, Round lake, Blue Mountain lake, Forked lake and Raquette lake.

The high region has a heavy rain-fall, the mean annual amounting to about forty-eight inches, or about ten inches above the mean for the State.

In its course through the mountains the river exhibits many falls and rapids, inviting power development under private enterprise. As yet, however, only 400 feet of the 1,400 feet of fall in the river, below Tupper lake, has been developed. The river has tremendous fluctuations between the maximum and minimum flow and is in great need of artificial regulation if the best possibilities of power development are to be realized. The State of New York Conservation Commission has, under consideration extensive storage developments on this stream which, when completed, will materially benefit the existing powers and tend to make the undeveloped portions of greater economic importance.

*Raquette River at Raquette Falls, near Coreys, N. Y.*

*Location.*—Six miles above Axton, five miles below the outlet of Long Lake and two miles below the mouth of Moose creek.

*Records available.*—August 27, 1908, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—Four hundred and eighteen square miles.

*Gage.*—A staff fastened to the right bank in a comparatively smooth section between two small falls; read once daily during the open water period and weekly during the ice period; datum unchanged since station was established.

*Channel.*—Rough, composed of large boulders; permanent; one channel at all stages.

*Discharge measurements.*—Made from car and cable about ten feet above the gage.

*Winter flow.*—Relation of gage height to discharge somewhat affected by ice.

*Accuracy.*—Low water section of discharge curve well defined; but few measurements have been made at high water, and determinations of flow for stages above gage height five feet may be somewhat in error.

*Co-operation.*—Established and maintained in co-operation with the State Water Supply Commission of New York.

The discharge at this station, added to that of Bog river near Tupper lake shows in a general way the amount of water flowing into Tupper lake, a study of which is being made to determine the amount of storage feasible in the lake. The combined drainage areas equal about 75 per cent. of the drainage at Piercefield.

*Discharge measurements of Raquette River at Raquette Falls, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
Feb. 22 a.....	W. G. Hoyt.....	Feet. 72	Sq. ft. 239	Feet. 2.11	Sec.-ft. 336

a Ice along shore; but relation of gage height to discharge not affected thereby.

*Daily gage height, in feet, of Raquette River at Raquette Falls, N. Y., for 1911.*

[C. A. De Lancett, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....				2.9	6.1	4.4	2.8	1.2	1.4	1.6	2.5	3.1
2.....				2.8	6.3	4.4	2.7	1.2	1.4	1.8	2.5	3.1
3.....				2.7	6.6	4.3	2.7	1.1	1.3	1.9	2.5	3.0
4.....		2.5	2.0	2.7	6.4	4.2	2.6	1.1	1.2	2.0	2.5	3.0
5.....				2.8	6.2	4.2	2.5	1.1	1.2	2.5	2.5	3.0
6.....				2.8	6.0	4.2	2.4	1.1	1.2	2.5	2.6	3.0
7.....		3.4		3.1	5.9	4.1	2.3	1.1	2.2	2.5	2.6	3.0
8.....				3.2	5.7	4.1	2.2	1.1	2.2	2.5	2.7	2.9
9.....				3.4	5.4	4.0	2.2	1.0	1.9	2.5	2.7	2.9
10.....				3.4	5.4	3.9	2.1	1.0	1.9	2.5	2.8	2.9
11.....		2.2	1.9	3.5	5.3	3.4	2.1	1.1	1.8	2.5	2.8	3.2
12.....				3.5	5.2	3.4	1.9	1.1	1.8	2.5	2.8	3.5
13.....				3.6	5.1	3.4	1.8	1.0	2.0	2.4	2.9	4.0
14.....	3.4			3.8	5.0	3.7	1.7	1.0	2.0	2.4	2.9	4.4
15.....				4.1	4.9	3.7	1.7	1.0	1.9	2.4	3.9	4.4
16.....				4.4	4.8	3.9	1.6	1.0	1.9	2.4	2.9	4.4
17.....				4.5	4.8	4.0	1.6	1.0	1.8	2.4	2.9	4.5
18.....		2.2	1.8	4.7	4.7	4.0	1.7	1.0	1.8	2.5	3.0	4.4
19.....				4.7	4.7	3.7	1.8	1.3	1.8	2.6	3.0	4.3
20.....				4.6	5.0	3.6	1.7	1.3	1.7	2.6	3.0	4.2
21.....	2.4			4.6	4.9	3.5	1.6	1.2	1.7	2.6	3.0	4.2
22.....		2.1		4.6	4.7	3.5	1.5	1.2	1.7	2.7	3.0	4.1
23.....				4.7	4.7	3.4	1.4	1.2	1.7	2.7	3.1	4.1
24.....				4.7	5.5	3.4	1.4	1.1	1.7	2.7	3.1	4.1
25.....		2.1	2.2	4.8	5.5	3.3	1.4	1.1	1.6	2.7	3.1	4.2
26.....				4.9	5.1	3.3	1.4	1.1	1.6	2.6	3.0	4.2
27.....				5.2	4.7	3.3	1.4	1.0	1.6	2.6	3.0	4.3
28.....	2.2			5.4	4.7	3.2	1.4	1.0	1.6	2.6	3.0	4.1
29.....				5.4	4.6	3.0	1.3	1.8	1.6	2.5	3.1	4.0
30.....				5.9	4.4	2.9	1.3	1.7	1.5	2.5	3.1	3.9
31.....					4.3		1.3	1.5		2.5		3.7

NOTE.—Extent to which the gage heights were affected by ice somewhat uncertain. Probably, however, more or less backwater from ice from about January 1 to about February 10. The measurement made February 22 indicated no backwater due to ice. Gage readings probably to water surface. Probably backwater from a log jam during the latter part of May and the first part of June. When the log jam was removed June 10 to 11, there was a sudden drop in stage indicating approximately 0.5 foot of backwater from this cause during the first part of June.



*Daily discharge, in second-feet, of Raquette River at Raquette Falls, N. Y., for 1911.*

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		300	655	4,220	1,860	600	110	150	190	460	770
2.....		290	600	4,540	1,860	550	110	150	240	460	770
3.....		290	550	5,030	1,750	550	90	130	265	460	710
4.....		290	550	4,700	1,640	505	90	110	290	460	710
5.....		280	600	4,380	1,640	460	90	110	460	460	710
6.....		280	600	4,060	1,640	420	90	110	460	505	710
7.....		270	770	3,960	1,540	385	90	350	460	505	710
8.....		270	830	3,580	1,540	350	90	350	460	550	655
9.....		265	970	3,130	1,450	350	70	265	400	550	655
10.....		265	970	3,130	1,360	320	70	265	400	600	655
11.....		265	1,640	2,980	970	320	90	240	460	600	830
12.....	350	250	1,040	2,840	970	265	90	240	460	600	1,040
13.....	350	250	1,120	2,700	970	240	70	290	420	655	1,450
14.....	350	250	1,280	2,570	1,200	215	70	290	420	655	1,860
15.....	350	250	1,540	2,440	1,200	215	70	265	420	1,360	1,860
16.....	350	240	1,860	2,320	1,360	190	70	265	420	655	1,860
17.....	350	240	1,970	2,320	1,450	190	70	240	420	655	1,970
18.....	350	240	2,200	2,200	1,450	215	70	240	460	710	1,860
19.....	340	240	2,200	2,200	1,200	240	130	240	505	710	1,750
20.....	330	250	2,080	2,570	1,120	215	130	215	505	710	1,640
21.....	320	260	2,080	2,440	1,040	190	110	215	505	710	1,640
22.....	320	270	2,080	2,200	1,040	170	110	215	550	710	1,540
23.....	320	280	2,200	2,200	970	150	110	215	550	770	1,540
24.....	320	300	2,200	3,280	970	150	90	215	550	770	1,540
25.....	320	350	2,320	3,280	900	150	90	190	550	770	1,640
26.....	320	380	2,440	2,700	900	150	90	190	505	710	1,640
27.....	320	410	2,840	2,200	900	150	70	190	505	710	1,750
28.....	320	450	3,130	2,200	830	150	70	190	505	710	1,750
29.....		500	3,130	2,080	710	130	240	190	460	770	1,450
30.....		550	3,900	1,860	655	130	215	170	460	770	1,360
31.....		600		1,750		130	170		460		1,200

NOTE.—Daily discharge determined from a fairly well-defined discharge rating curve. The open-channel rating curve has been applied throughout the period February 11 to December 31, with no corrections for possible backwater from ice or from log jams. Discharge interpolated for periods when the gage was not read.

*Monthly discharge of Raquette River at Raquette Falls, near Coreys, N. Y., for 1910.*  
[Drainage area, 418 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....			250	.598	.69	D
February.....			300	.718	.75	D
March.....			1,500	3.59	4.14	D
April.....	3,740	1,640	2,550	6.10	6.81	.....
May.....	3,430	1,040	1,980	4.74	5.46	.....
June.....	1,970	420	1,150	2.75	3.07	.....
July.....	420	150	226	.541	.62	.....
August.....	290	150	218	.522	.60	.....
September.....	460	190	299	.715	.80	.....
October.....	420	240	304	.727	.84	.....
November.....	460	320	388	.928	1.04	.....
December.....			200	.478	.55	D
The year.....	3,740		780	1.87	25.37	

NOTE.—Mean daily discharge for January, February, March, and December has been estimated from the discharge at Piercesfield and at other stations in northern New York. The determinations are only approximate.

No revision has been made in the discharge published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 Report of the Engineer and Surveyor, State of New York.

*Monthly discharge of Raquette River at Raquette Falls, N. Y., for 1911.*  
 [Drainage area, 418 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	390	350	373	.892	1.03	C
February.....	350	320	341	.816	.85	C
March.....	600	240	311	.744	.86	B
April.....	3,900	550	1,660	3.97	4.43	A
May.....	5,030	1,750	2,970	7.11	8.20	A
June.....	1,860	655	1,240	2.97	3.31	A
July.....	600	130	272	.651	.75	A
August.....	240	70	101	.242	.28	B
September.....	350	110	216	.517	.58	A
October.....	550	190	446	1.07	1.23	A
November.....	1,360	460	657	1.57	1.75	A
December.....	1,970	655	1,290	3.09	3.56	A
The year.....	5,030	70	825	1.97	26.83	

NOTE.— Discharge for January 1 to February 10 was estimated from climatological records and the discharge at other stations in the Raquette River basin.  
 Mean discharge February 1 to 10, estimated 350 second-feet.

#### *Raquette River at Piercefield, N. Y.*

*Location.*— About three-fourths mile above the head of Black Rapids and one-half mile below the dam of International Paper Company at Piercefield.

*Records available.*— August 20, 1908, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*— 723 square miles.

*Gage.*— From August 20, 1908, to September 3, 1910, a vertical staff fastened to a large pine stump in a pond-like stretch of the stream controlled by Black Rapids; after September 3, 1910, chain gage fastened to same stump. Both gages installed at the same datum, which has remained unchanged.

*Channel.*— Permanent.

*Discharge measurements.*— Made at low and medium stages from a boat just above Black Rapids; at high stages made from the highway bridge about three-fourths mile above the station and one-fourth mile above the dam of the International Paper Company.

*Winter flow.*— The rapids controlling the stream at the gage rarely freeze and measurements made with ice present indicate that the relation between gage height and discharge is little if any affected by ice. Open water discharge rating curve usually applicable throughout the year.

*Artificial control.*— The dam of the International Paper Company controls the flow of the stream at the station during low water periods, but the mill is usually run for 24 hours each day, except Sundays. The numerous lakes in the upper part of the drainage basin afford considerable storage, most of which is controlled.

*Accuracy.*— Although the discharge at this station is somewhat affected by artificial control, the records are believed to be good.

*Co-operation.*— Established by the United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of Raquette River at Piercefield, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 23 a.....	F. J. Shuttleworth.....	258	796	5.10	888
June 30.....	G. H. Canfield.....	95	562	5.40	1,060
Sept. 10 b.....	G. H. Canfield.....	49	56.0	1.54	51.6

a Measurement made under complete ice cover about 4 miles below gage. Average thickness of ice .93 feet. Ice at gage section, complete cover. Average thickness of ice about 2.5 feet. Control point free from ice cover; some ice on rocks and side.

b Measurement made by wading about 300 yards below boat section.

*Daily gage height, in feet, of Raquette River at Piercefield, N. Y., for 1910.*

[W. B. Graves, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.00	2.65	2.40	.....	6.80	.....	4.80	1.60	1.9	2.10	2.40	2.50
2.....	1.00	2.60	2.70	.....	6.80	.....	4.35	1.40	1.80	1.00	2.48	2.30
3.....	2.00	2.60	2.70	7.45	6.80	.....	1.00	1.40	1.70	1.35	2.50	2.30
4.....	1.95	.....	2.70	7.50	6.85	.....	1.00	1.30	0.0	2.10	2.58	0.0
5.....	.....	2.60	2.70	7.50	6.85	.....	3.50	1.40	0.0	2.15	2.50	2.12
6.....	2.00	1.50	1.85	7.55	6.70	.....	3.40	1.40	1.85	2.10	1.5	2.25
7.....	.....	2.50	3.35	7.50	6.60	.....	2.90	0.0	2.12	2.15	1.55	2.20
8.....	1.90	2.70	4.25	7.50	6.40	.....	2.25	0.0	2.10	2.20	2.25	2.00
9.....	1.10	2.60	4.25	7.50	6.40	.....	2.30	1.65	2.15	.15	2.40	1.90
10.....	2.00	.....	4.25	7.30	6.40	.....	1.60	2.00	2.20	.85	3.05	1.90
11.....	.....	.....	4.25	7.50	6.40	.....	2.10	0.0	0.0	1.75	2.65	0.0
12.....	2.00	2.50	4.25	7.50	6.35	.....	2.20	0.0	3.25	2.10	2.75	0.0
13.....	2.60	2.40	3.60	7.50	6.30	.....	1.95	0.0	2.30	2.05	0.0	2.10
14.....	2.60	2.70	4.80	7.40	5.90	.....	2.20	0.0	1.95	2.10	1.70	2.05
15.....	2.00	.....	4.80	7.30	5.45	.....	2.00	0.0	1.75	2.00	3.05	2.00
16.....	1.10	2.70	4.85	7.10	5.60	.....	1.90	0.0	1.90	1.5	3.20	2.00
17.....	.....	.....	4.85	6.80	5.55	.....	1.00	0.0	1.60	2.05	3.15	1.55
18.....	1.95	2.70	4.85	6.75	5.50	.....	2.00	1.00	2.20	2.20	3.05	0.0
19.....	1.80	2.70	4.80	6.90	5.40	.....	2.00	2.15	2.20	2.35	3.10	1.50
20.....	2.00	2.70	4.65	6.40	5.10	.....	2.05	1.65	2.20	2.40	0.0	2.00
21.....	.....	2.70	4.65	6.50	5.40	.....	2.10	.30	2.20	2.40	1.60	1.90
22.....	2.00	2.70	4.60	6.40	5.00	.....	2.15	0.0	2.20	2.40	2.40	1.90
23.....	1.00	2.70	4.50	6.40	5.60	.....	2.20	1.32	2.20	.15	2.80	1.90
24.....	2.45	2.70	4.50	5.90	5.00	.....	1.00	1.90	2.20	1.30	3.00	1.90
25.....	2.50	2.70	4.50	7.00	5.60	4.80	1.75	2.15	2.0	2.05	3.00	0.0
26.....	2.50	2.90	4.80	6.80	5.40	4.60	2.15	2.05	1.00	2.15	3.10	0.0
27.....	2.50	1.90	5.10	6.80	5.40	4.80	2.20	2.00	1.35	2.20	0.0	0.0
28.....	2.50	.....	6.10	6.90	5.40	5.40	2.20	.20	2.15	2.32	1.65	0.0
29.....	2.50	.....	6.40	6.90	5.40	5.40	1.95	0.0	2.20	2.40	2.40	0.0
30.....	2.10	.....	6.90	6.80	5.40	4.80	1.90	1.75	2.10	.20	2.50	0.0
31.....	2.55	.....	6.65	.....	5.40	.....	0.0	2.05	.....	1.55	.....	.....

NOTE.—Some of the gage readings for this station are erroneous, and for this cause gage readings as recorded by the observer from June 1 to 24 are omitted altogether. The readings recorded as 0 in the above table are especially incorrect, the gage height probably being considerably higher on those days. In the period December 27 to 31 the plant of the International Paper Co. is known to have been in operation; on other days for which the gage height is recorded as 0 or other abnormally low value, the plant is assumed to have been closed and the discharge stored above the dam.

Gage heights January 1 to March 12, are to the top of ice. December gage heights are probably to water surface.

*Daily gage height, in feet, of Raquette River at Piercefield, N. Y., for 1911.*  
[W. B. Graves, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.0	4.7	5.2	4.9	10.4	7.6	5.6	5.5	3.3	1.10	3.8	5.6
2.....	3.5	4.9	5.2	2.0	10.4	7.6	2.7	5.1	3.4	2.9	4.0	5.6
3.....	4.0	5.1	5.2	5.0	10.3	7.5	4.3	3.7	3.5	3.9	4.0	5.7
4.....	4.1	5.2	5.2	5.6	10.4	4.3	5.0	2.6	3.6	3.7	3.9	5.9
5.....	4.1	2.0	2.0	5.7	10.4	6.3	5.4	2.4	3.8	3.6	1.45	5.9
6.....	4.1	4.0	3.5	5.5	10.4	6.4	5.4	2.05	4.0	3.6	2.4	6.0
7.....	4.1	5.2	4.0	5.6	10.1	6.4	5.4	2.10	3.9	3.5	3.2	6.0
8.....	2.0	5.4	4.2	5.8	9.7	6.4	5.4	3.45	3.8	.95	4.0	6.0
9.....	3.5	5.4	4.2	5.6	9.8	6.4	2.4	3.7	3.7	2.3	4.2	6.0
10.....	5.0	5.4	4.1	6.2	9.6	6.4	4.2	4.0	1.7	2.6	4.1	3.8
11.....	5.0	5.4	4.2	6.4	9.5	5.2	4.5	4.0	1.55	2.7	4.0	5.9
12.....	5.0	2.0	2.0	6.4	9.4	6.5	4.4	4.0	2.35	2.8	1.9	6.0
13.....	5.0	3.1	3.5	6.4	9.4	6.5	4.3	1.85	4.2	2.8	5.8	6.1
14.....	5.0	4.3	4.2	6.4	9.0	6.5	4.4	2.2	4.3	2.95	5.4	6.1
15.....	2.0	4.7	4.1	6.3	9.1	6.5	4.4	2.15	4.4	1.05	5.2	6.2
16.....	3.5	4.7	4.2	6.1	9.0	6.4	2.5	3.9	4.4	3.6	5.0	6.3
17.....	5.0	4.7	4.1	6.5	8.9	6.4	3.25	4.0	2.5	4.0	4.9	7.8
18.....	5.0	4.7	4.2	6.6	8.8	5.2	3.9	2.15	3.4	4.1	5.0	7.8
19.....	5.0	2.0	2.0	6.6	8.6	6.2	4.2	1.95	3.9	4.0	2.65	7.5
20.....	5.0	3.7	3.5	6.7	8.6	6.3	4.2	1.75	4.0	4.0	5.5	7.5
21.....	5.0	5.2	4.2	6.8	7.2	6.3	4.2	1.9	4.0	4.1	5.9	7.4
22.....	2.0	5.2	4.2	6.5	7.6	6.3	4.5	4.0	3.4	2.3	5.8	7.5
23.....	4.9	5.2	4.1	7.8	7.6	6.4	2.7	4.0	3.3	3.2	5.9	7.4
24.....	4.8	5.2	4.2	8.3	7.8	6.3	4.0	2.2	1.35	3.8	5.9	6.7
25.....	4.9	5.2	4.2	8.5	7.7	4.2	4.2	2.1	3.0	4.0	5.9	6.5
26.....	5.0	2.0	2.0	8.7	7.6	5.3	3.8	2.0	3.8	4.0	5.3	7.6
27.....	5.0	5.2	3.6	8.8	7.6	6.0	3.6	1.9	3.7	4.0	5.3	7.6
28.....	4.8	5.2	5.0	8.8	7.3	6.1	2.7	3.45	3.6	3.8	5.6	7.1
29.....	2.0	.....	4.9	8.5	7.4	6.1	2.55	3.3	3.6	2.35	5.6	7.1
30.....	3.5	.....	5.0	8.7	7.6	5.6	2.35	3.2	3.5	2.85	5.6	7.1
31.....	4.0	.....	4.9	.....	7.6	.....	4.5	3.25	.....	3.7	.....	7.1

NOTE.—Relation of gage height to discharge not usually affected by ice at this station. The gage readings are taken in a pond above a swift control point which usually remains open throughout the winter. Gage readings probably to water surface. The fluctuation of the gage heights is under the control of the paper mill above the station.

*Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for 1910.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	487	735	635	(3,820)	3,980	.....	2,020	369	456	521	635	675
2.....	218	715	755	(4,720)	3,980	.....	1,680	316	426	218	667	595
3.....	487	715	755	4,720	3,980	.....	218	316	397	303	675	595
4.....	472	(715)	755	4,780	4,040	.....	218	290	90	521	707	90
5.....	(480)	715	755	4,780	4,040	.....	1,160	316	90	539	675	528
6.....	487	342	441	4,840	3,870	.....	1,000	316	441	521	101	576
7.....	(472)	675	1,080	4,780	3,760	.....	845	90	528	539	356	557
8.....	456	755	1,600	4,780	3,560	.....	576	90	521	557	576	487
9.....	241	715	1,600	4,780	3,560	.....	595	383	539	101	635	456
10.....	487	(715)	1,600	4,540	3,560	.....	218	487	557	186	920	456
11.....	(487)	(675)	1,600	4,780	3,560	.....	521	90	90	412	735	90
12.....	487	675	1,600	4,780	3,500	.....	557	90	1,020	521	778	90
13.....	715	635	1,220	4,780	3,450	.....	472	90	595	504	90	521
14.....	715	755	2,020	4,660	3,050	.....	557	90	472	521	397	504
15.....	487	(755)	2,020	4,540	2,600	.....	487	90	412	487	920	487
16.....	241	755	2,060	4,320	2,750	.....	456	90	456	101	995	487
17.....	(356)	(755)	2,060	3,980	2,700	.....	218	90	369	504	970	356
18.....	472	755	2,060	3,920	2,650	.....	487	218	105	557	920	90
19.....	426	755	2,020	4,090	2,560	.....	487	539	557	615	945	342
20.....	487	755	1,900	3,560	2,290	.....	504	383	557	635	90	487
21.....	(487)	755	1,900	3,660	2,560	.....	521	114	557	635	369	456
22.....	487	755	1,860	3,560	2,750	.....	539	90	557	635	635	456
23.....	218	755	1,780	3,560	2,750	.....	557	295	557	101	800	456
24.....	655	755	1,780	3,050	2,750	.....	218	456	557	290	895	456
25.....	675	755	1,780	4,200	2,750	2,020	412	539	105	504	895	90
26.....	675	845	2,020	3,980	2,560	1,860	539	504	218	539	945	90
27.....	675	456	2,290	3,980	2,560	2,020	557	487	303	557	90	450
28.....	675	(456)	3,250	4,090	2,560	2,560	557	105	539	603	383	450
29.....	675	.....	3,560	4,090	2,560	2,560	472	90	557	635	635	450
30.....	521	.....	4,090	3,980	2,560	2,020	456	412	521	105	675	450
31.....	695	.....	3,820	.....	2,560	.....	90	504	.....	356	.....	450

NOTE.—Daily discharge determined from a well-defined discharge rating curve. During the period January 1 to March 12, when the gage heights were taken to the top of the ice, the discharge rating curve was applied directly as the ice was less than one-half foot thick and was probably constantly in a state of flotation. Discharge for days on which gage height was recorded as o, estimated at 90 second-feet, except December 27 to 31, when the plant of the International Paper Co. is known to have been running. For these days the discharge is estimated at 450 second-feet. The discharge for the period August 11 to 17 is subject to considerable doubt.

*Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for 1911.*

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	88	730	940	810	5,880	2,750	1,160	1,100	290	28	425	1,160
2.....	342	810	940	88	5,880	2,750	161	895	316	196	485	1,160
3.....	485	895	940	850	5,750	2,650	580	397	342	455	485	1,220
4.....	515	940	940	1,160	5,880	580	850	147	369	397	455	1,350
5.....	515	88	88	1,220	5,880	1,630	1,040	124	425	369	47	1,350
6.....	515	485	342	1,100	5,880	1,700	1,040	92	485	369	124	1,420
7.....	515	940	485	1,160	5,500	1,700	1,040	96	455	342	265	1,420
8.....	88	1,040	545	1,280	5,020	1,700	1,040	329	425	22	485	1,420
9.....	342	1,040	545	1,160	5,140	1,700	124	397	397	114	545	1,420
10.....	850	1,040	515	1,560	4,900	1,700	545	485	64	147	515	425
11.....	850	1,040	545	1,700	4,780	940	650	485	54	161	485	1,350
12.....	850	88	88	1,700	4,660	1,780	615	485	118	177	80	1,420
13.....	850	244	342	1,700	4,660	1,780	580	76	545	177	1,280	1,490
14.....	850	580	545	1,700	4,200	1,780	615	105	580	207	1,040	1,490
15.....	88	730	515	1,630	4,320	1,780	615	100	615	26	940	1,560
16.....	342	730	545	1,490	4,200	1,700	135	455	615	369	850	1,630
17.....	850	730	515	1,780	4,090	1,700	278	485	135	485	810	2,950
18.....	850	730	545	1,860	3,980	940	455	100	316	515	850	2,950
19.....	850	88	88	1,860	3,760	1,560	545	84	455	485	154	2,650
20.....	850	397	342	1,940	3,760	1,630	545	68	485	485	1,100	2,650
21.....	850	940	545	2,020	2,380	1,630	545	80	485	515	1,350	2,560
22.....	88	940	545	1,780	2,750	1,630	650	485	316	114	1,280	2,650
23.....	810	940	515	2,950	2,750	1,700	161	485	290	265	1,350	2,560
24.....	770	940	545	3,450	2,950	1,630	485	105	41	425	1,350	1,940
25.....	810	940	545	3,660	2,850	545	545	96	218	485	1,350	1,780
26.....	850	88	88	3,870	2,750	990	425	88	425	485	990	2,750
27.....	850	940	369	3,980	2,750	1,420	369	80	397	485	990	2,750
28.....	770	940	850	3,980	2,470	1,490	161	329	369	425	1,160	2,290
29.....	88	.....	810	3,660	2,560	1,490	141	290	369	119	1,160	2,290
30.....	342	.....	850	3,870	2,750	1,160	119	265	342	186	1,160	2,290
31.....	485	.....	810	.....	2,750	.....	650	278	.....	397	.....	2,290

NOTE.—Daily discharge determined from a well-defined discharge rating curve. The accuracy of the daily discharge is not greatly affected by the operation of the mill above the station, as the plant runs continuously except occasionally on Sundays or other times when it is closed for repairs.

*Monthly discharge of Raquette River, at Piercefield, N. Y., for 1910.*  
 [Drainage area, 723 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	605	218	503	.696	.80	B
February.....	845	342	700	.968	1.01	B
March.....	4,090	635	1,830	2.53	2.92	A
April.....	4,840	3,050	4,270	5.91	6.59	A
May.....	4,040	2,290	3,110	4.30	4.96	A
June.....	.....	.....	(2,040)	(2.82)	(3.15)	D
July.....	2,020	90	587	.812	.94	A
August.....	539	90	269	.372	.43	B
September.....	1,020	90	438	.606	.68	A
October.....	635	101	446	.617	.71	A
November.....	995	90	637	.881	.98	A
December.....	675	90	410	.567	.65	A
The year.....	4,840	90	1,270	1.757	23.82	

NOTE.—Discharge for June estimated from the discharge at Massena Springs. Monthly discharge for this station, as published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the New York State Engineer and Surveyor, has been corrected.

*Monthly discharge of Raquette River at Piercafield, N. Y., for 1911.*  
 [Drainage area, 723 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....	850	88	587	.812	.94	B
February.....	1,040	88	715	.989	1.03	B
March.....	945	88	543	.751	.87	B
April.....	3,980	88	2,330	2.81	3.14	A
May.....	5,880	2,380	4,120	5.71	6.58	A
June.....	2,750	580	1,600	2.22	2.48	A
July.....	1,160	119	544	.752	.87	B
August.....	1,100	76	293	.405	.47	B
September.....	615	41	358	.495	.55	B
October.....	515	22	304	.420	.48	B
November.....	1,350	47	785	1.09	1.22	B
December.....	2,950	425	1,890	2.61	3.01	A
The year.....	5,880	22	1,150	1.59	21.64	

*Raquette River at Massena Springs, N. Y.*

*Location.*—A highway bridge at Massena Springs, N. Y., 1,000 feet above the New York Central railroad bridge used for freight transfer from the railroad station to the Massena power plant, one-quarter mile from the New York Central railway station on the highway bridge leading to Massena, 8 miles below Raymondville and 10 miles above the mouth of the stream.

*Records available.*—September 21, 1903, to October 17, 1903, April 9, 1904, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—1,170 square miles.

*Gage.*—Original gage a vertical staff fastened to a stone wall on the left bank 25 feet upstream from the bridge. Staff gage was replaced August 16, 1906, by a standard chain gage fastened to upstream side of highway bridge. The datum of the chain gage was made 1.00 foot lower than the staff gage in order to avoid negative readings. During the summer and fall of 1911 a new concrete bridge was constructed just below the old bridge. During the period of construction gage readings were obtained from a temporary staff gage fastened to the railroad bridge. Readings were also made at the regular gage and special discharge measurements were made to develop the proper discharge rating curves for this period.

*Channel.*—Bed of river of coarse gravel and small boulders; permanent; current good at all points; formerly one channel, now two; slight correction necessary for angle.

*Discharge measurements.*—Previous to construction of new bridge, made from upstream side of highway bridge; no measurements have yet been made from new bridge. The new bridge has two spans and will undoubtedly cause some change in the discharge rating curve.

*Artificial control.*—The operation of a number of power plants above the station has marked effect on the low water discharge of the stream. These plants are usually run for 24-hour power, but are closed on Sundays. The effect of the Sunday closing is shown in the stream for several days.

*Winter flow.*—Ice forms at this station to a thickness of 3 feet and considerably affects the relation of gage height to discharge for December, January, February, and March.

**Accuracy.**—Determinations of monthly discharge considered good but those of daily discharge may be considered in error for low water periods due to artificial control. Monthly estimates for periods during which ice is present also subject to large errors.

**Co-operation.**—Established by the United States Geological Survey in co-operation with the State Engineer and Surveyor of New York, maintained in co-operation with United States Geological Survey.

*Discharge measurements of Raquette River at Massena Springs, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	*Mean gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 20 a.....	W. G. Hoyt.....	170	416	4.48	909
April 12 b.....	C. S. De Golyer.....	174	1,680	9.51	4,790
July 3.....	G. H. Canfield.....	170	470	2.79	1,050
Sept. 8.....	G. H. Canfield.....	167	300	1.80	387
Sept. 11.....	G. H. Canfield.....	163	304	c 1.84	406
Sept. 12.....	G. H. Canfield.....	172	454	d 2.66	863
Sept. 12.....	G. H. Canfield.....	129	328	e 2.30	612
Nov. 21.....	G. S. De Golyer.....	172	741	f 4.30	1780

\* Chain gage. a Measurement made under complete ice cover. Gage height to top of ice 4.58 feet. Average thickness of ice 2.24 feet. b Open water at bridge. Ice jammed below and above causing backwater. c Gage height, staff gage 2.84 feet. d Gage height, staff gage 3.64 feet. e Gage height, staff gage 3.30 feet. f Gage height, staff gage 4.99 feet.

*Daily gage height, in feet, of Raquette River at Massena Springs, N. Y., for 1911*

[Fred L. Babcock, observer.]

DAY.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.6			5.9	8.4	5.6	3.6	1.8	1.75	2.8	3.7	5.4
2.....					9.2	5.5	3.3	2.05	2.05	3.8	3.35	5.2
3.....					9.4	5.6	3.0	1.85	1.7	3.5	3.9	4.8
4.....			4.6		9.4	5.2	3.0	1.75	1.8	3.2	3.9	6.2
5.....		4.7			9.2	5.2	3.0	1.5	1.75	3.2	3.7	6.5
6.....					9.0	4.8	3.4	1.65	2.0	3.1	3.25	5.8
7.....	4.5				8.8	4.8	3.2	1.8	1.85	3.6	3.9	6.1
8.....				10.5	9.0	4.6	2.8	1.85	1.75	3.4	4.0	5.2
9.....					8.7	4.4	2.25	2.0	1.8	3.7	3.7	5.0
10.....					8.4	4.6	2.2	1.85	2.8	4.3	4.3	5.0
11.....			4.8		8.0	4.0	3.0	1.75	1.8	3.6	4.4	5.4
12.....		4.7		9.4	7.8	4.4	3.1	1.55	3.35	3.6	4.4	5.6
13.....				9.2	7.4	4.4	2.8	1.75	3.3	3.0	3.6	5.7
14.....				8.6	7.2	4.6	1.85	1.75	3.1	3.6	4.2	7.1
15.....	4.5			8.2	6.9	4.4	1.75	1.85	3.25	2.95	4.4	7.0
16.....				8.0	6.7	4.4	1.75	1.85	3.85	2.8	4.0	7.1
17.....				8.0	6.6	4.3	2.0	2.05	3.85	3.3	4.2	6.8
18.....			5.1	7.6	6.4	4.2	3.1	1.82	2.9	3.4	4.7	6.8
19.....		4.6		7.4	6.3	4.4	2.7	1.75	3.15	3.6	5.1	5.8
20.....				7.4	6.2	4.0	2.6	1.75	3.3	3.3	5.6	5.7
21.....				7.4	5.8	4.1	2.5	1.45	3.15	3.3	5.2	5.6
22.....	4.4			7.4	5.6	4.1	2.8	1.55	2.9	3.35	4.8	5.4
23.....				7.2	5.35	4.1	1.9	1.85	2.85	3.25	4.8	5.8
24.....				7.2	5.4	4.0	1.55	1.9	2.9	3.6	4.6	6.0
25.....		4.7	5.3	7.10	7.6	3.6	1.7	1.95	3.1	3.8	5.2	6.0
26.....				7.2	7.6	3.8	2.45	1.9	3.5	3.6	5.0	6.0
27.....				7.6	7.0	3.8	2.35	1.7	3.1	3.4	4.6	5.6
28.....				7.8	6.4	3.8	2.0	1.6	2.9	3.8	4.8	5.6
29.....	4.4			8.0	6.3	3.7	1.85	1.75	3.0	3.6	4.8	7.7
30.....				8.1	6.0	3.65	1.65	1.75	2.85	3.9	4.9	8.8
31.....					5.8		1.65	1.85		3.8		8.6

NOTE.—Relation of gage height to discharge affected by ice from January 1 to about April 16, and from about December 29 to 31. Gage heights to water surface, except those for January 1 and 7, which are to the top of the ice.

From about July 1 to December 13 the gage heights read from the chain gage were affected by construction work at the new bridge. Some uncertainty also exists regarding the gage heights from December 19 to 31, owing to the possibility of a permanent change in the relation of gage height to discharge, caused by the construction work at the bridge, which was completed on December 13. All gage readings were taken on the chain gage, except for the periods September 12 to December 3 and December 7 to 18, when they were read from a temporary staff gage established on the railroad bridge below the bridge to which the chain gage is attached.

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for 1911.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		7,160	3,680	1,660	465	365	385	875	2,200
2.....		8,350	3,580	1,420	592	505	945	662	2,020
3.....		8,650	3,680	1,200	490	345	750	1,020	1,690
4.....		8,650	3,280	1,200	442	385	580	1,020	3,650
5.....		8,350	3,280	1,200	335	365	580	875	4,000
6.....		8,050	2,880	1,500	398	480	530	608	3,250
7.....		7,750	2,880	1,350	465	408	810	1,020	2,900
8.....		8,050	2,700	1,060	490	365	690	1,080	2,020
9.....		7,600	2,500	705	565	385	875	875	1,850
10.....		7,160	2,700	675	490	945	1,300	1,300	1,850
11.....		6,590	2,140	1,200	442	385	810	1,380	2,200
12.....	4,800	6,310	2,500	1,280	355	662	810	1,380	2,400
13.....	5,000	5,780	2,500	1,060	442	635	480	810	2,500
14.....	5,500	5,520	2,700	490	442	530	810	1,230	4,040
15.....	6,000	5,150	2,500	442	490	608	455	1,380	3,920
16.....	6,200	4,910	2,500	442	490	980	385	1,080	4,040
17.....	6,590	4,790	2,420	565	592	980	635	1,230	3,680
18.....	6,040	4,560	2,320	1,280	475	430	690	1,610	3,680
19.....	5,780	4,440	2,500	990	442	555	810	1,940	3,680
20.....	5,780	4,330	2,140	925	442	635	635	2,300	3,560
21.....	5,780	3,890	2,240	860	315	555	635	2,020	3,450
22.....	5,780	3,680	2,240	1,060	355	430	662	1,690	3,230
23.....	5,520	3,420	2,240	515	408	408	608	1,690	3,680
24.....	5,520	3,480	2,140	355	430	430	810	1,530	3,920
25.....	5,400	6,040	1,800	420	455	530	945	2,020	3,920
26.....	5,520	6,040	1,960	828	430	750	810	1,850	3,920
27.....	6,040	5,270	1,960	765	345	530	690	1,530	3,450
28.....	6,310	4,560	1,960	565	305	430	945	1,690	3,450
29.....	6,590	4,440	1,880	490	365	480	810	1,690	3,300
30.....	6,730	4,110	1,840	398	365	408	1,020	1,770	3,200
31.....		3,890		398	408		945		3,000

NOTE.—Daily discharge determined by means of four discharge rating curves: (1) A well-defined curve, used during 1910, applicable for the open-water period until June 30; (2) a rating curve based on a measurement made July 3, applicable July 1 to August 22, curve only fairly well-defined and period of application uncertain; (3) a well-defined curve constructed from four measurements made during September, and applicable, though with some uncertainty regarding the period, from August 23 to September 11, and (4) a well-defined curve constructed from measurements made during September and November, and applicable to the staff gage readings September 12 to December 3 and December 7 to 18; also applicable to chain gage readings December 4 to 6 and December 19 to 31, with a correction of + 0.6 feet for December 4 to 6 and + 1.0 feet for December 19–31.

Daily discharge May 13 to 16 and December 29 to 31 estimated.

Monthly discharge of Raquette River at Massena Springs, N. Y., for 1910.

[Drainage area, 1170 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....			(690)	(.590)	(.68)	D
February.....			(960)	(.820)	(.85)	D
March.....	(6,310)		(4,040)	(3.45)	(3.98)	B
April.....	5,520	2,980	4,560	3.90	4.35	A
May.....	4,110	2,460	3,210	2.74	3.16	A
June.....	3,080	1,350	2,390	2.04	2.28	A
July.....	1,590	433	770	.658	.76	A
August.....	1,160	284	538	.460	.53	A
September.....	1,060	284	668	.569	.63	A
October.....	1,590	388	928	.791	.91	A
November.....	1,630	457	1,210	1.03	1.15	B
December.....			(660)	.564	.65	D
The year.....	6,310	284	1,720	1.47	19.93	

NOTE.—Discharge for January, February, and December estimated from the discharge at Piercefield.

No revision has been made in the determinations of discharge published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the Engineer and Surveyor, State of New York.



*Monthly discharge of Raquette River at Massena Springs, N. Y., for 1911.*  
 [Drainage area, 1,170 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....			1,400	1.20	1.38	D
February.....			1,200	1.03	1.07	C
March.....			1,350	1.15	1.33	C
April.....	6,730		4,800	4.10	4.57	B
May.....	8,650	3,420	5,840	4.99	5.75	A
June.....	3,680	1,800	2,520	2.15	2.40	A
July.....	1,680	355	881	.753	.87	B
August.....	592	345	436	.373	.43	B
September.....	980	345	530	.453	.51	A
October.....	1,300	385	737	.630	.73	A
November.....	2,300	808	1,370	1.17	1.30	A
December.....	4,040	1,690	3,150	2.69	3.10	B
The year.....	8,650	305	2,020	1.73	23.44	

NOTE.—Discharge January 1 to April 11 determined from the discharge at Piercefield plus an inflow between Piercefield and Massena Springs estimated from consideration of general conditions affecting run-off in northern New York.

Mean discharge April 1 to 11 estimated 3,000 second-feet.

*Bog River near Tupper Lake, N. Y.*

*Location.*—Mouth of Bog river, head of Tupper lake, 1½ miles below the junction of Bog river and the outlet of Round pond.

*Records available.*—August 24, 1908, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—132 square miles.

*Gage.*—Staff, fastened to the left wing wall of an unused dam; read once daily; datum unchanged since established.

*Channel.*—Possibly shifting, as the bed is composed of rock on one side and gravel on the other. The crest of the dam with the brink of the adjacent falls forms a control point considered permanent.

*Discharge measurements.*—Made from a car and cable about 1½ miles above the gage and immediately below the mouth of the outlet of Round pond.

*Artificial control.*—The flow is more or less regulated during the spring for log driving. The operation of a small power plant on the main stream causes some variation in the daily gage heights during the low-water periods in the summer.

*Winter flow.*—The gage readings are usually omitted from December to March on account of ice.

*Accuracy.*—Low water portion of the discharge curve well developed. As few higher measurements have been made, determinations of discharge for stages above gage height 4 feet, may be somewhat in error.

*Co-operation.*—Established and maintained in co-operation with the State of New York Conservation Commission.

Bog river and its tributary drain a number of small lakes and ponds among which are Higgings, First, Second and Third ponds on the tributary, all of which lie south and southwest of Big Tupper Lake. The station is important in connection with stations on the Raquette at Raquette Falls and Piercefield in the study of storage feasible in Tupper Lake.

Daily gage height in feet of Bog River near Tupper Lake, N. Y., for 1911.

[B. O. Lott, observer.]

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.	2.1	4.5	3.0	2.0	1.1	1.0	1.3	1.4
2.	2.1	4.9	3.0	2.0	1.1	1.0	1.3	1.4
3.	2.1	4.9	2.8	1.9	1.0	1.0	1.3	1.4
4.	2.2	4.8	2.8	1.8	1.0	1.0	1.3	1.4
5.	2.4	4.8	2.8	1.7	1.0	1.0	1.4	1.4
6.	2.6	4.7	2.6	1.6	1.0	1.0	1.4	1.5
7.	2.7	4.5	2.8	1.6	1.0	1.0	1.5	1.5
8.	2.7	4.2	2.8	1.6	1.0	1.0	1.4	1.5
9.	2.6	4.0	2.6	1.6	1.0	1.0	1.4	1.5
10.	2.9	3.8	2.4	1.5	.9	1.1	1.4	1.6
11.	3.2	3.5	2.4	1.5	.9	1.2	1.4	1.9
12.	3.7	3.2	2.4	1.4	.9	1.2	1.4	2.4
13.	4.0	3.1	2.4	1.4	.9	1.2	1.4	2.5
14.	4.2	3.0	2.5	1.4	.8	1.2	1.4	2.5
15.	4.1	3.0	2.6	1.4	.8	1.3	1.4	2.5
16.	4.2	2.8	2.5	1.4	.8	1.3	1.4	2.6
17.	4.2	2.7	2.4	1.4	.9	1.3	1.4	2.6
18.	4.3	2.6	2.4	1.4	.9	1.3	1.4	2.7
19.	4.3	2.5	2.4	1.4	1.0	1.3	1.5	2.7
20.	4.3	2.5	2.5	1.5	1.0	1.3	1.5	2.8
21.	4.3	2.4	2.4	1.4	.9	1.3	1.4	2.8
22.	4.2	2.4	2.4	1.4	.9	1.3	1.4	2.7
23.	4.2	2.6	2.6	1.2	.9	1.3	1.5	2.6
24.	4.2	3.0	2.5	1.2	.9	1.3	1.5	2.6
25.	4.3	3.4	2.3	1.2	.9	1.3	1.5	2.6
26.	4.3	3.4	2.2	1.2	.9	1.3	1.5	2.6
27.	4.3	3.4	2.1	1.1	.9	1.3	1.5	2.7
28.	4.3	3.4	2.1	1.1	1.0	1.4	1.4	2.9
29.	4.2	3.4	2.1	1.0	1.0	1.4	1.4	3.1
30.	4.3	3.2	2.0	1.1	1.0	1.4	1.4	3.1
31.	4.3	3.0		1.1	1.0	1.4	1.4	

NOTE.—No information available regarding the extent to which ice existed at this station during 1911.

Daily discharge, in second-feet, of Bog River near Tupper Lake, N. Y., for 1910.

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.	500	186	625	60	28	28	72	100
2.	500	1,650	580	60	28	37	85	100
3.	495	1,580	535	60	28	48	85	100
4.	340	325	535	48	28	60	72	100
5.	495	825	455	48	28	60	85	115
6.	415	720	375	72	28	48	85	131
7.	208	1,230	310	85	28	48	85	131
8.	770	254	280	85	28	60	72	115
9.	825	1,610	280	72	37	72	60	115
10.	670	1,580	340	48	48	85	60	115
11.	825	1,470	375	60	48	92	60	131
12.	1,060	1,130	340	60	48	85	72	148
13.	770	340	310	48	37	85	85	148
14.	720	230	280	37	28	72	85	166
15.	625	186	280	37	28	72	100	230
16.	1,600	186	280	37	28	60	85	254
17.	1,470	186	310	37	37	48	72	230
18.	1,330	230	375	37	37	60	72	230
19.	340	208	455	37	28	60	60	230
20.	1,000	1,330	375	37	28	60	60	230
21.	1,360	1,260	310	37	28	72	85	230
22.	148	495	310	37	28	60	100	230
23.	405	455	254	37	28	60	85	230
24.	186	535	186	37	28	60	85	230
25.	48	648	166	28	28	60	85	254
26.	100	625	131	28	20	60	100	254
27.	148	625	85	28	14	60	100	186
28.	148	625	72	37	14	60	115	166
29.	106	625	72	37	14	60	115	166
30.	1,650	670	72	48	14	60	100	148
31.		625		37	20		100	

NOTE.—Daily discharge determined from a discharge rating curve fairly well defined below about 800 second-feet. Discharge April 1 and 2 estimated.

*Daily discharge, in second-feet, of Bog River near Tupper Lake, N. Y., for 1911.*

DAY.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....	180	1,260	455	166	37	28	60	72
2.....	186	1,540	455	166	37	28	60	72
3.....	186	1,540	375	148	28	28	60	72
4.....	208	1,470	375	131	28	28	60	72
5.....	254	1,470	375	115	28	28	72	72
6.....	310	1,400	310	100	28	28	72	85
7.....	340	1,260	375	100	28	28	85	85
8.....	346	1,060	375	100	28	28	72	85
9.....	310	940	310	100	28	28	72	85
10.....	415	825	254	85	20	37	72	100
11.....	535	670	254	85	20	48	72	148
12.....	770	535	254	72	20	48	72	254
13.....	940	495	254	72	20	48	72	280
14.....	1,060	455	280	72	14	48	72	280
15.....	1,000	455	310	72	14	60	72	280
16.....	1,000	375	280	72	14	60	72	310
17.....	1,060	340	254	72	20	60	72	310
18.....	1,130	310	254	72	20	60	72	340
19.....	1,130	280	254	72	28	60	85	340
20.....	1,130	280	280	85	28	60	85	375
21.....	1,130	254	254	85	0	60	72	375
22.....	1,060	280	254	72	20	60	72	340
23.....	1,060	310	310	48	20	60	85	310
24.....	1,060	455	280	48	20	60	85	310
25.....	1,130	625	230	48	20	60	85	310
26.....	1,130	670	208	48	20	60	85	310
27.....	1,130	625	186	37	20	72	85	340
28.....	1,130	625	186	37	28	72	72	415
29.....	1,060	625	186	28	28	72	72	495
30.....	1,130	535	166	37	28	72	72	495
31.....	.....	455	.....	37	28	.....	72	.....

NOTE.—Daily discharge determined from a discharge rating curve fairly well defined below about 800 second-feet.  
Discharge April 1 estimated.

*Monthly discharge of Bog River near Tupper Lake, N. Y., for 1910.*

[Drainage area, 132 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF. Depth in inches on drainage area.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January.....	.....	.....	100	.758	.87	D
February.....	.....	.....	100	.758	.79	D
March.....	.....	.....	500	3.79	4.37	D
April.....	1,690	48	648	4.91	5.48	B
May.....	1,650	186	730	5.53	6.38	C
June.....	625	72	312	2.36	2.63	B
July.....	85	28	47.0	.356	.41	B
August.....	48	14	28.8	.218	.25	B
September.....	92	28	61.7	.467	.52	B
October.....	115	60	83.3	.631	.73	B
November.....	254	100	140	1.06	1.18	B
December.....	.....	.....	80	.606	.70	D
The year.....	1,690	14	236	1.79	24.31	

NOTE.—Monthly discharge for January, February, March and December estimated from a consideration of general conditions of run-off in northern New York. Values approximate.

No revision has been made of discharge data published in the Sixth Annual Report of the New York State Water Supply Commission and the 1910 report of the New York State Engineer and Surveyor, although values for April published in those reports were changed by the addition of the estimated discharge on April 1 and 2.

*Monthly discharge of Bog River near Tupper Lake, N. Y., for 1911.*  
[Drainage area, 132 square miles.]

MONTH.	DISCHARGE IN SECOND-FEET.				RUN-OFF.	Accu- racy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	
January.....	.....	.....	120	.909	1.05	D
February.....	.....	.....	100	.758	.79	D
March.....	.....	.....	120	.909	1.05	D
April.....	1,130	180	783	5.93	6.62	A
May.....	1,540	254	723	5.48	6.32	A
June.....	455	166	286	2.17	2.42	A
July.....	166	28	80.1	.607	.70	A
August.....	37	14	23.9	.181	.21	C
September.....	72	28	49.6	.376	.42	A
October.....	85	60	73.8	.559	.64	A
November.....	495	72	247	1.87	2.09	A
December.....	.....	.....	450 *	3.41	3.93	D
The year.....	1,540	14	255	1.93	26.24	

NOTE.—Discharge January, February, March, and December estimated from climatological records and general conditions of run-off in northern New York.

#### ST. REGIS RIVER DRAINAGE BASIN.

##### *Description.*

The St. Regis river has its source in several small streams and lakes in the western part of Franklin county at an elevation of about 1,500 feet above the sea. It first flows in a northwesterly direction for about forty miles and then somewhat east of north for about 28 miles to its mouth, in the St. Lawrence river near the State line. It has a drainage area of 664 square miles (State Water Supply Commission). The upper portion of its water shed consists of swamp and mountains from which the forest has been largely cut. Upon leaving the plateau the stream descends for 10 or 15 miles through a rugged country with a succession of steep rapids and precipitous falls to the low lands bordering the St. Lawrence.

There are excellent opportunities for developing power in the descent, only a few of which have as yet been utilized. From the foot of the hills to the St. Lawrence, the slope of the river is moderate and rock out-crop not frequent, consequently favorable sites for power development are scarce. According to report of the State Water Supply Commission for 1910, the present limit of profitable development through this low country, except as increased by regulation of stream flow has probably been reached in the existing plants. A detailed description, showing all power developments and future possible developments is given in the 1910 report of the State Water Supply Commission.

##### *St. Regis at Brasher Center, N. Y.*

*Location.*—At the steel highway bridge in the village of Brasher Center, 5 miles downstream from Brasher Falls,  $6\frac{1}{4}$  miles below the junction of East and West branches of St. Regis river, and about 12 miles above the mouth.

*Records available.*—August 22, 1910, to December 31, 1911. Data also in annual reports of the United States Geological Survey, State Water Supply Commission, and the State Engineer and Surveyor, State of New York.

*Drainage area.*—621 square miles (measured on Post Route map).

*Gage.*—Chain, fastened to downstream side of bridge; read twice daily; datum unchanged.

*Channel.*—Very rough; composed of gravel and large boulders; considered permanent. Velocity of current at high stages very swift and water rough.

*Discharge measurements.*—At low stages made by wading about 500 feet below the bridge; at high stages made from the bridge.

*Winter flow.*—Relation of gage height to discharge affected by ice.

*Accuracy.*—Discharge rating curve not yet developed.

*Co-operation.*—Established by United States Geological Survey in co-operation with the State of New York Conservation Commission.

*Discharge measurements of St. Regis River at Brasher Center, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 20 <i>a</i> .....	Shuttleworth and Hoyt.....	222	223	7.15	526
April 13.....	C. S. De Golyer.....	220	729	6.30	3,956
April 13.....	C. S. De Golyer.....	221	734	6.26	3,850
July 2.....	G. H. Canfield.....	209	345	4.57	709

*a* Measurement made under complete ice cover about 400 feet above gage. Gage height to top of ice 7.20 feet; average thickness of ice 0.85 foot.

*Daily gage height, in feet, of St. Regis River at Brasher Center, N. Y., for 1911.*

DAY.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		5.70	6.20	4.75	4.55	4.28	4.15	4.42	4.48	5.32
2.....		5.55	6.68	4.72	4.52	4.25	4.05	4.45	4.72	5.32
3.....		5.60	6.32	4.82	4.55	4.10	4.02	4.42	4.75	5.08
4.....		5.40	6.20	4.80	4.62	4.08	4.05	4.60	4.59	4.95
5.....		5.15	5.90	4.74	4.56	4.15	4.10	5.00	4.52	4.85
6.....		8.25	5.80	4.80	4.48	4.22	4.15	5.20	4.51	4.71
7.....		8.70	5.55	4.85	4.62	4.29	4.75	5.12	4.60	4.78
8.....		8.80	5.50	4.65	4.45	4.28	4.78	4.95	4.90	4.72
9.....		7.25	5.42	4.68	4.48	4.20	4.68	4.78	5.08	4.95
10.....		6.60	5.35	4.90	4.41	4.32	4.45	4.68	5.06	5.10
11.....		6.35	5.30	4.65	4.42	4.15	4.30	4.45	5.04	5.35
12.....		6.20	5.30	4.80	4.45	4.05	4.38	4.40	5.04	5.52
13.....		6.40	5.12	4.92	4.18	4.19	4.35	4.55	4.85	6.10
14.....		6.70	5.05	5.12	4.15	4.12	4.38	4.38	4.84	6.08
15.....		6.85	5.15	5.15	4.08	4.08	4.45	4.38	4.82	6.82
16.....		6.80	4.55	5.25	4.15	4.15	4.38	4.36	4.76	5.72
17.....		6.75	4.85	5.12	4.08	4.12	4.32	4.38	4.80	5.35
18.....		6.65	4.68	4.95	4.32	4.09	4.28	4.45	4.90	6.28
19.....		6.10	4.75	4.72	4.25	4.12	4.40	4.55	5.15	5.40
20.....		6.25	4.55	4.60	4.35	4.25	4.40	4.06	5.09	6.32
21.....		5.95	4.58	4.72	4.22	4.30	4.38	4.52	5.06	6.25
22.....		6.15	4.65	4.82	4.19	4.25	4.25	4.52	5.04	5.18
23.....		6.18	4.78	4.65	4.10	4.22	4.22	4.45	4.92	5.55
24.....		6.02	4.70	4.52	4.08	4.20	4.25	4.48	4.49	5.60
25.....		6.00	5.95	4.38	4.15	4.30	4.22	4.35	4.78	5.42
26.....		6.18	5.55	4.38	4.05	4.21	4.35	4.45	4.72	5.38
27.....		6.28	5.25	4.58	4.18	4.32	4.72	4.44	4.70	5.30
28.....		7.95	6.25	5.05	4.67	3.98	4.15	5.02	4.42	4.75
29.....		6.88	6.28	5.05	4.55	4.09	4.35	4.42	4.41	5.20
30.....		6.15	6.25	4.85	4.59	3.95	4.32	4.35	4.38	5.35
31.....		5.80		4.75		3.98	4.38		4.48	5.78

*NOTE.*—Relation of gage height to discharge probably affected by backwater from ice during the latter part of March, the first part of April, and the last few days of December. It is not known when the ice passed out of the river.

## AUSABLE RIVER DRAINAGE BASIN.

*Description.*

The Ausable river is formed by the junction of the east and west branches which have their headwaters in the northwestern part of Essex county. The east branch has its source in upper Ausable lake, at an elevation of 1,990 feet above sea level. The west branch is formed by several small streams which lie in the valley to the west and north of the east branch. Both branches flow north and east to their junction in the village of Ausable Forks, from which point the river flows northeast, entering Lake Champlain about 10 miles south of Plattsburg and opposite and slightly north of the city of Burlington.

Throughout the entire course, the river is fed by small mountain streams, which enter at nearly right angles from the mountains on either side. There are few lakes in this drainage area to act as a regulator on the flow and, owing to the great differences of elevation throughout the area, the stream has what is called a flashy discharge, its fluctuations being large and rapid.

Owing to the fact that this basin lies on the eastern slope of the Adirondack mountains, the average rain fall is less than for those basins whose streams rise on the western and southern slopes, the mean yearly precipitation being about 32 inches.

About 6,000 water horsepower is developed at the present time, principally on the west branch. For additional development and storage possibilities on this stream see Fifth Annual Report of Water Supply Commission, pages 88, 147, 267.

*Ausable River at Ausable Forks, N. Y.*

*Location.*—In the village of Ausable Forks, immediately below the junction of the east and west branches and about 15 miles above the mouth of the river.

*Records available.*—August 17, 1910, to December 31, 1911. Data also in annual reports of the State Water Supply Commission of New York and New York State Conservation Commission.

*Drainage area.*—470 square miles.\*

*Gage.*—Chain, on the left bank, about 100 feet below the junction of east and west branches of Ausable river; read twice daily; datum unchanged.

*Channel.*—Sand and gravel; liable to shift. Divided by an island.

*Discharge measurements.*—Made from a car hung on a cable about 1½ miles below the gage. At this place the river flows in one channel.

*Winter flow.*—Ice may form on the riffles below the gage and either divert or cause back water.

*Accuracy.*—Conditions at the measuring section good. Discharge rating curve not yet developed.

*Co-operation.*—Established by the United States Geological Survey in co-operation with the State Water Supply Commission of New York.

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\* Measured on Post Route map.

*Discharge measurements of Ausable River at Ausable Forks, N. Y., in 1911.*

DATE.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
Feb. 25 a.....	F. J. Shuttleworth.....	245	207	3.63	188
April 14.....	C. S. De Golyer.....	186	680	4.96	2,130
April 14.....	C. S. De Golyer.....	186	690	4.97	2,160
June 28 b.....	G. H. Canfield.....	171	254	3.73	308
Aug. 10 b.....	G. H. Canfield.....	156	169	3.54	152

a Measurement made by wading about 300 feet above gage. Section of cable frozen over. Average thickness of ice 1.2 feet. Section of gage nearly clear of ice.  
 b Measurements by wading at cable section.

*Daily gage height, in feet, of Ausable River at Ausable Forks, N. Y., for 1911.*

[H. Edward Miner, observer.]

DAY.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		3.82	3.90	5.7	3.87	3.69	3.52	3.61	3.64	3.70	3.98
2.....		3.65	3.97	7.1	4.01	3.59	3.53	3.57	3.72	3.77	3.89
3.....		3.92	3.99	5.15	3.87	3.67	3.53	3.57	3.68	3.78	3.76
4.....		3.63	4.03	4.70	3.79	3.60	3.54	3.57	3.70	3.76	3.84
5.....		3.65	3.84	4.35	3.81	3.58	3.50	3.58	4.35	2.63	3.78
6.....		3.76	5.05	4.25	3.71	3.58	3.49	4.00	4.16	3.67	3.76
7.....		3.88	5.9	4.30	3.77	3.60	3.56	4.18	3.94	3.77	3.70
8.....		3.66	5.00	4.65	3.67	3.57	3.58	3.84	3.75	4.13	3.71
9.....		3.65	4.27	4.80	3.88	3.53	3.60	3.63	3.78	4.00	3.75
10.....		3.62	4.33	4.80	3.94	3.57	3.55	3.64	3.76	3.88	3.65
11.....		3.63	4.29	4.65	3.91	3.56	3.56	3.62	3.76	3.88	3.99
12.....		3.66	4.30	4.75	3.99	3.52	3.51	3.64	3.69	3.95	4.70
13.....		3.92	4.48	4.55	4.52	3.56	3.52	3.66	3.64	4.43	5.7
14.....		3.86	5.10	4.14	4.31	3.48	3.53	3.62	3.63	4.07	4.85
15.....		3.90	5.6	4.09	4.17	3.48	3.52	3.62	3.64	3.91	4.44
16.....		4.02	5.00	3.93	4.23	3.54	3.56	3.67	3.63	3.82	4.18
17.....		3.98	4.60	4.47	4.15	3.56	3.52	3.61	3.58	3.80	4.15
18.....		3.72	4.45	3.94	3.95	3.61	3.50	3.70	3.69	3.84	4.05
19.....		3.64	4.28	4.09	3.83	3.70	3.48	3.62	4.36	3.86	3.88
20.....		3.68	4.38	4.07	3.79	3.62	3.54	3.62	4.19	3.80	4.14
21.....		3.73	4.34	3.91	3.76	3.56	3.66	3.56	4.05	3.78	3.99
22.....		3.70	4.28	3.97	3.73	3.56	3.53	3.66	4.10	3.72	3.80
23.....		3.82	4.28	3.92	3.71	3.49	3.56	3.62	4.20	3.68	4.56
24.....		4.70	4.22	4.03	3.75	3.53	3.55	3.58	4.06	3.74	4.68
25.....	3.63	3.91	4.44	4.11	3.55	3.54	3.62	3.72	3.92	3.76	4.28
26.....	3.66	4.18	4.75	4.09	3.85	3.60	3.56	3.64	3.82	3.51	4.14
27.....	3.92	4.46	4.95	3.95	3.69	3.79	3.54	3.68	3.78	3.65	3.97
28.....	4.07	4.85	5.35	3.83	3.66	3.55	3.56	3.62	3.77	3.69	3.92
29.....		4.36	5.55	3.83		3.55	3.64	3.64	3.66	4.02	4.22
30.....		4.14	5.55	3.72		3.55	3.68	3.68	3.66	4.02	4.70
31.....		3.98		3.69		3.60	3.63		3.69		4.70

The relation of gage height to discharge was known to be affected by ice February 25. It is probable that there was also backwater effect from ice from January 1 until some time in March.

**SUMMARY OF DISCHARGE.**  
Summary of discharge, in second-feet per square mile, for all river stations for which such data are available in this report.

STATION.	Drain- age area.	1910												
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	Sq. mi.													
Hudson River at North Creek, N. Y.	804	738	842	4.53	4.43	2.06	2.29	632	1.19	1.23	1.41	1.13	.709	1.84
Hudson River at Thurman, N. Y.	1,550	.581	.774	4.19	4.39	2.55	2.45	.828	.787	.916	1.03	.961	(.555)	1.65
Hudson River at Mechanicville, N. Y.	4,500	1.15	1.22	4.76	3.91	2.05	2.27	358	.442	.504	.582	.740	.447	1.53
Schroon River at Riverbank, N. Y.	524	1,352	1,890	3.58	5.21	3.18	2.62	487	.348	.652	.689	.747	.410	1.58
Sacandaga River at Wells, N. Y.	263	1.40	1.14	6.84	5.40	3.61	3.14	245	.608	1.17	.996	1.22	.458	2.19
Sacandaga River at Northville, N. Y.	740	1.22	1.01	7.16	6.22	3.55	3.03	331	.408	.703	.811	1.15	.473	2.19
Sacandaga River at upper bridge, Hadley, N. Y.	1,050	1.07	.971	7.34	5.78	3.37	3.47	.341	.443	.582	.663	1.08	.517	2.14
Sacandaga River at cable station, Hadley, N. Y.	1,050													
Sacandaga River at lower bridge, Hadley, N. Y.	1,060		.962	5.32	3.01	1.81	.305		.394	.693	.653	.928		
Genesee River at St. Helena, N. Y.	1,030	1.11	.854	4.96	2.49	1.86	384	160	.126	.224	.213	.701	.638	1.24
Genesee River at Jones' Bridge, N. Y.	1,410	.993	.709	4.96	2.49	1.86	384	.161	.123	.226	.228	.547	.466	1.12
Genesee River at Rochester, N. Y.	2,360	.814	.534	4.49	1.96	1.75								.975
Salmon River at Stillwater Bridge, near Redfield, N. Y.	191													
Salmon River near Pulaski, N. Y.	264									1.20	1.60	2.73	1.27	
Orwell Brook near Altmar, N. Y.	221													
Black River near Boonville, N. Y.	279													
Moose River at Moose River, N. Y.	346	1.73	1.45	8.76	5.61	3.35	2.35	.746	1.96	1.18	1.97	1.79	.890	2.65
Middle Branch Moose River at Old Forge, N. Y.	515													
Oswegatchie River near Ogdensburg, N. Y.	1,580	1.24	1.06	4.92	2.05	1.44	.981	.366	.372	.585	.854	2.03	1.16	1.42
Baquette River at Raquette Falls, N. Y.	418	.698	.718	3.59	6.10	4.74	2.75	.541	.522	.715	.727	.928	.478	1.87
Baquette River at Mercersfield, N. Y.	723	.696	.948	2.53	5.91	4.30	(2.82)	.812	.372	.606	.617	.881	.567	1.76
Baquette River at Massena Springs, N. Y.	1,170	(.590)	(.820)	(3.45)	3.90	2.74	2.04	.558	.460	.569	.791	1.03	.564	1.47
Bog River near Tupper Lake, N. Y.	132	.758	.758	3.79	4.91	5.53	2.36	.356	.218	.467	.631	1.06	.606	1.79

\* July 14-31, 1910.



## SUMMARY OF DISCHARGE — Concluded.

STATION.	Drain- age area.	1911.												
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	Sq. mi.													
Hudson River at North Creek, N. Y.	804	.933	.852	.840	4.44	3.26	1.53	.878	.984	.650	1.15	1.26	2.30	1.59
Hudson River at Thurman, N. Y.	1,550	.774	.645	.806	4.52	2.83	1.21	.595	.556	.458	.839	1.01	1.81	1.34
Hudson River at Mechanicville, N. Y.	4,500	1.17	.749	1.28	3.73	2.06	.985	.302	.262	.444	1.61	1.68	2.22	1.34
Schroon River at Riverbank, N. Y.	534	.669	.408	.581	3.99	2.66	1.17	.354	.186	.283	.624	1.14	1.99	1.18
Sacandaga River at Wells, N. Y.	263	.913	.646	.943	5.89	5.06	2.26	.253	.126					
Sacandaga River at Northville, N. Y.	740													
Sacandaga River at upper bridge, Hadley, N. Y.	1,050													
Sacandaga River at cable station, Hadley, N. Y.	1,050	.981	.700	1.19	5.64	2.79	1.40	.282	.192	.628	2.55	2.55	3.54	1.88
Sacandaga River at lower bridge, Hadley, N. Y.	1,030													
Genesee River at St. Helena, N. Y.	1,030	2.67	1.52	2.67	2.59	7.09	.643	.137	.482	.613	.991	1.41	1.78	1.35
Genesee River at Jones' Bridge, N. Y.	1,410	2.48	1.56	2.80	2.21	.636	.452	.133	.409	.544	.759	1.10	1.52	1.21
Genesee River at Rochester, N. Y.	2,360	2.17	1.61	2.67	2.17	.614	.458	.194	.250	.382	.598	.873	1.30	1.11
Salmon River at Stillwater Bridge, near Redfield.	191								.576	1.24	2.74	4.40	6.49	
Salmon River near Pulaski, N. Y.	264				12.8	3.30	2.53	.856	.496	.123	2.08	3.70	5.80	
Orwell Brook near Altmar, N. Y.	22.1						.417	.758	.356	.837	1.29	3.01	4.05	
Black River near Boonville, N. Y.	279	1.34	.986	2.18	8.28	3.91	2.05	.234	.284	.569	1.29	2.84	4.70	2.39
Moose River at Moose River, N. Y.	346	1.73	1.16	2.02	7.60	4.80	1.71	.928	.584	.705	2.26	2.73	4.83	2.59
Middle Branch Moose River at Old Forge, N. Y.	51.5													
Oswegatchie River near Ogdensburg, N. Y.	1,580	2.97	1.15	2.25	6.22	2.20	1.36	.549	.238	.515	.715	1.69	3.41	1.85
Raquette River at Raquette Falls, N. Y.	418	.892	.816	.744	3.97	7.11	2.97	.651	.242	.517	1.07	1.57	3.09	1.97
Raquette River at Pierrefield, N. Y.	723	.812	.989	.751	2.81	5.71	2.22	.752	.405	.405	.430	1.09	2.61	1.59
Raquette River at Massena Springs, N. Y.	1,700	1.20	1.03	1.15	4.10	4.99	2.15	.753	.373	.453	.630	1.17	2.69	1.73
Bog River near Tupper Lake, N. Y.	132	.909	.758	.909	5.93	5.48	2.17	.607	.181	.376	.559	1.87	3.41	1.93

† June 24-30, 1911.

‡ June 23-30, 1911.

§ Nov. 9-30, 1911.

## RAINFALL STUDIES.

Acting on the suggestions of Mr. John R. Freeman, Consulting Engineer of the State Water Supply Commission in 1907, experiments on comparative results of three old types of rain gages — Smithsonian, Fuertes and DeWitt conical gage — were conducted at Ithaca under the direction of Mr. Wilford M. Wilson, section director of the United States Weather Bureau. One each of these gages was placed on the ground and one at an elevation of ten feet above the ground. Daily observations were taken at each of these gages and at a standard United States Weather Bureau gage located in the immediate vicinity. The experiments were carried through three open seasons. The results are published in the following tables, which have not been published in full heretofore. The records tend to indicate that the percentage of error due to the use of different types of gages is very slight and that data gathered from any one of these gages would be comparable with those obtained by the standard Weather Bureau gage now in use. Doubtless, the errors due to improper location and irregular methods of observation were far greater than by use of the different types of gages.

*Summary of results of experiments with different types of rain-gages. Monthly recorded precipitation in inches.*

MONTH.	Gage No. 1.	Gage No. 2.	Gage No. 3.	Gage No. 4.	Gage No. 5.	Gage No. 6.	Gage No. 7.
<b>1908.</b>							
May.....	*4.55	5.13	5.36	4.80	5.21	5.37	4.71
June.....	*1.33	1.82	1.74	1.67	1.85	1.81	1.58
July.....	*5.02	4.81	4.80	4.77	4.94	4.87	4.50
August.....	3.69	3.62	3.66	3.42	3.82	3.82	3.48
September.....	1.60	1.53	1.53	1.48	1.53	1.56	1.36
October.....	1.68	1.67	1.65	1.76	1.80	1.64	1.61
November.....	.97	.90	.91	.85	.93	.90	.79
Total.....	18.84	19.48	19.66	18.75	20.08	19.97	18.03
Percentage of No. 1	100.0	103.4	104.4	99.5	106.6	106.0	95.7
<b>1909.</b>							
April.....	3.48	3.36	3.67	3.13	3.55	3.84	3.27
May.....	2.39	2.39	2.37	2.19	2.50	2.51	2.36
June.....	4.14	4.14	3.97	4.04	4.27	4.08	4.03
July.....	1.70	1.73	1.66	1.63	1.82	1.71	1.61
August.....	1.72	1.76	1.70	1.75	1.78	1.70	1.55
September.....	2.96	2.97	2.96	3.09	3.11	2.90	3.03
October.....	2.29	2.33	2.34	2.33	2.37	2.43	2.36
Total.....	18.68	18.68	18.67	18.16	19.40	19.17	18.20
Percentage of No. 1	100.0	100.0	99.9	97.2	103.9	102.6	97.4
<b>1910.</b>							
April.....	3.90	3.93	3.99	3.61	3.94	4.07	3.67
May.....	4.34	4.31	4.34	4.22	4.53	4.57	4.35
June.....	1.24	1.20	1.21	1.15	1.35	1.24	1.28
July.....	1.64	1.66	1.72	1.48	1.73	1.72	1.65
August.....	2.48	2.34	2.41	2.28	2.43	2.48	2.26
September.....	4.76	4.64	4.87	4.65	4.96	5.50	4.78
October.....	2.38	2.03	2.32	2.28	2.20	2.23	2.17
Total.....	20.74	20.11	20.86	19.67	21.14	21.81	20.16
Percentage of No. 1	100.0	97.0	100.6	94.8	101.9	105.2	97.2

## FOR THE SERIES.

Total inches.....	58.26	58.27	59.18	56.58	60.62	60.95	56.39
Percentage of No. 1	100.0	100.0	101.6	97.1	104.1	104.6	96.8

\* May, June, July, 1908, interpolated from gage at Weather Bureau office by series of totals ratios. No. 1 is a U. S. Weather Bureau standard gage. No. 2 is a Smithsonian gage, on the ground. No. 3 is a Fuertes gage, on the ground. No. 4 is a DeWitt conical gage, on the ground. No. 5 is a Smithsonian gage, 10 feet above the ground. No. 6 is a Fuertes gage, 10 feet above the ground. No. 7 is a DeWitt conical gage, 10 feet above the ground.

## FIRST ANNUAL REPORT OF THE

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the years 1910 and 1911.

MONTH.	FORKED LAKE.(b)		KEEPAWA.(c)		MOREHOUSEVILLE.		NORTH CREEK.	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1910.	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	3.79	30.25	3.80	39.00	3.80	25.00	5.73	22.50
February.....	6.21	45.50	8.24	57.75	5.05	52.00	5.35	33.50
March.....	2.43	11.50	2.17	9.50	1.08	2.50	0.78	0.50
April.....	2.87	4.25	2.37	2.00	3.50	1.00	3.56	.....
May.....	6.03	.....	5.43	.....	5.44	.....	3.53	.....
June.....	3.30	.....	4.62	.....	3.77	.....	2.71	.....
July.....	3.23	.....	3.24	.....	6.40	.....	1.99	.....
August.....	3.87	.....	5.21	.....	6.02	.....	4.74	.....
September.....	3.60	.....	3.72	.....	6.45	.....	4.11	.....
October.....	3.91	3.00	4.87	4.30	3.65	2.00	1.67	.....
November.....	2.63	25.13	3.34	27.50	3.21	27.00	1.87	6.00
December.....	4.15	34.00	5.04	55.20	2.07	27.50	1.98	10.00
Year.....	45.92	153.63	52.05	195.25	50.44	137.00	38.02	72.50
1911.	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	2.88	16.75	3.92	32.00	4.00	17.00	1.53	5.00
February.....	4.06	39.00	3.75	39.30	3.69	54.50	1.43	12.50
March.....	7.22	47.75	5.49	55.50	4.90	45.00	2.20	15.50
April.....	1.70	6.75	2.48	12.50	2.17	8.50	1.06	1.50
May.....	3.55	1.25	5.25	2.50	3.47	.....	1.80	.....
June.....	5.03	.....	5.12	.....	4.45	.....	2.73	.....
July.....	2.80	.....	2.79	.....	2.73	.....	2.74	.....
August.....	4.37	.....	3.00	.....	4.66	.....	3.03	.....
September.....	4.74	.....	3.78	.....	6.05	.....	3.82	.....
October.....	4.27	1.75	4.29	9.40	5.88	3.00	4.14	.....
November.....	6.27	33.25	6.43	47.30	5.64	49.50	2.47	(a)
December.....	4.96	12.10	4.14	12.50	4.89	6.25	3.81	4.00
Year.....	51.85	158.60	50.44	211.00	52.53	186.75	30.76	*38.50

\* Record incomplete.

(a) No snow record given for November, 1911.

(b) Also published as Raquette Lake, in previous reports. Privately taken records are available at this station since November, 1892.

(c) Also published as Nehasane, in previous reports.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the years 1910 and 1911.

MONTH.	OLD FORGE.		POTSDAM.		BLUE RIDGE.		TUPPER LAKE.(d)	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1910.	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	5.32	38.60	2.84	21.00	No record	No record	2.08	17.00
February.....	5.84	51.40	3.56	28.50	No record	No record	4.79	45.00
March.....	1.00	7.20	0.82	5.00	No record	No record	0.52	3.50
April.....	2.31	0.75	1.74	.....	No record	No record	No record	.....
May.....	6.51	.....	3.31	.....	No record	No record	No record	.....
June.....	3.00	.....	1.14	.....	No record	No record	No record	.....
July.....	5.16	.....	1.00	.....	No record	No record	No record	.....
August.....	6.60	.....	3.83	.....	No record	No record	No record	.....
September.....	3.48	.....	2.21	.....	No record	No record	No record	.....
October.....	3.96	.....	5.15	.....	No record	No record	No record	.....
November.....	3.66	24.00	2.33	(a)	0.97	(c)	1.92	13.00
December.....	4.51	42.80	2.99	(a)	2.40	19.25	2.25	12.25
Year.....	51.35	164.75	30.92	*54.50	*3.43	*19.25	*11.56	90.75
1911.								
January.....	4.12	24.40	1.71	(a)	1.85	13.25	2.28	7.00
February.....	3.56	45.10	4.02	7.75	2.12	22.00	2.30	8.00
March.....	4.43	39.20	3.83	10.00	1.54	15.50	2.73	18.00
April.....	1.33	4.50	1.94	.....	1.24	3.00	0.73	(c)
May.....	3.17	.....	1.34	.....	1.75	.....	4.04	3.00
June.....	7.35	.....	4.84	.....	3.85	.....	4.73	.....
July.....	3.01	.....	3.33	.....	2.06	.....	2.05	.....
August.....	3.75	.....	4.26	.....	2.63	.....	2.38	.....
September.....	3.76	.....	4.44	.....	3.50	.....	2.49	.....
October.....	3.63	1.30	2.84	.....	4.48	.....	3.10	2.00
November.....	6.54	43.50	3.37	6.25	(b)	(b)	2.62	9.75
December.....	0.88	8.20	3.05	4.00	(b)	(b)	3.50	1.00
Year.....	45.53	166.20	38.97	*23.00	*25.02	*53.75	32.95	48.75

\* Record incomplete.

(a) No snow record given for November or December, 1910, or January, 1911.

(b) Discontinued November 1, 1911.

(c) Record not given.

(d) January, February, and March record taken at Faust. Station re-established in November 1910, at Tupper Lake village.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the years 1910 and 1911.

MONTH.	HORSESHOE.		KNOWELHURST.		NORTHVILLE.		WAKELY DAM.	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1910.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
September.....	No record	No record	No record	No record	(b) 6.11	.....	No record	No record
October.....	(a) 2.18	(a)	(c) 2.00	10.12	2.13	5.80	No record	No record
November.....	3.62	35.50	2.95	13.50	2.61	9.60	(d) 2.65	27.00
December.....								
Year.....	*5.80	*35.50	*4.95	*23.62	*12.27	*15.40	*2.65	*27.00
1911.								
January.....	1.52	12.50	2.23	8.25	2.45	9.00	3.08	20.80
February.....	1.43	15.50	2.32	25.00	1.80	15.50	2.90	3.75
March.....	1.65	24.50	2.29	17.75	3.39	25.25	No record (e)	No record
April.....	1.07	3.50	1.20	8.75	1.74	4.50	No record	No record
May.....	5.63	2.00	3.24	.....	2.29	.....	No record	No record
June.....	4.53	.....	4.10	.....	4.63	.....	No record	No record
July.....	2.77	.....	2.20	.....	3.23	.....	(e) 1.77	.....
August.....	3.05	.....	2.66	.....	5.05	.....	4.35	.....
September.....	4.23	.....	4.31	.....	6.74	.....	3.60	.....
October.....	5.13	3.50	5.95	5.00	6.95	.....	4.12	.....
November.....	3.40	27.00	2.66	5.75	5.87	5.00	No record (f)	No record (f)
December.....	4.81	17.75	3.23	5.00	2.29	5.00	No record (f)	No record (f)
Year.....	39.22	106.25	36.39	75.50	46.43	64.25	*19.82	*24.55

\* Record incomplete. (a) Established November 4, 1910. (b) Record began September 1, 1910. (c) Established November 2, 1910. (d) Established December 11, 1910. (e) No record March 1 to July 15, 1911. (f) No record November 1 to December 31, 1911.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the years 1910 and 1911.

MONTH.	WANEKENA.		WARDS CREEK.		WELLS.		ALT MAR.	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1910.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
September.....	No record	No record	No record	No record	7.18	.....	.....	.....
October.....	4.78	.....	No record	No record	2.06	.....	.....	.....
November.....	2.33	21.00	2.08	17.25	3.66	(c)	.....	.....
December.....	3.58	38.50	3.46	26.00	1.99	10.00	.....	.....
Year.....	*10.69	*59.50	*5.54	*43.25	*14.89	*10.00	.....	.....
1911.								
January.....	3.30	18.00	2.73	21.25	1.62	6.15	No record	No record
February.....	4.20	47.00	2.34	21.00	2.53	17.25	No record	No record
March.....	5.03	47.50	3.08	23.00	(d)	.....	No record	No record
April.....	1.34	4.50	3.82	5.00	(d) 0.40	.....	No record	No record
May.....	4.04	5.00	3.93	6.50	3.93	.....	(e) 2.18	.....
June.....	3.25	.....	5.70	.....	4.30	.....	8.65	.....
July.....	2.75	.....	(a)	.....	1.43	.....	3.09	.....
August.....	2.15	.....	4.62	.....	3.47	.....	3.96	.....
September.....	2.87	.....	4.61	.....	5.05	.....	3.26	.....
October.....	3.37	2.50	4.50	0.34	5.40	.....	3.97	.....
November.....	4.55	36.25	3.79	(b) 21.38	4.63	8.50	5.18	15.25
December.....	3.26	10.50	4.70	12.88	4.16	4.50	1.28	(f)
Year.....	40.11	171.25	*43.91	*111.35	*36.98	36.40	*31.57	*15.25

\* Record incomplete. (a) No record for July, 1911. (b) Snow record incomplete, first storm not measured. (c) No snow record for November, 1910. (d) No record March first to April tenth, inclusive. (e) Established May 22, 1911. (f) No snow record for December, 1911.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the year 1911.

MONTH.	BENNETT BRIDGE.		BOONVILLE.		HOOKER.		LEISHER MILLS.	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1911.	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	No record	No record	No record	No record	No record	No record	No record	No record
February.....	No record	(c) 0.31	No record	No record	No record	No record	No record	No record
March.....	No record	2.67	No record	No record	No record	No record	No record	No record
April.....	No record	1.69	No record	No record	No record	No record	No record	No record
May.....	(a) 1.45	3.72	No record	No record	(d) 0.99	No record	(f) 2.86	No record
June.....	9.61	0.12	0.12	7.72	7.72	6.27	6.27	6.27
July.....	3.08	4.10	4.10	3.88	3.88	3.74	3.74	3.74
August.....	3.92	4.29	4.29	3.39	3.39	4.16	4.16	4.16
September.....	3.66	2.71	2.71	4.60	4.60	5.35	5.35	5.35
October.....	4.14	4.60	4.60	6.03	6.03	6.21	6.21	6.21
November.....	No record (b)	5.48	19.56	5.25	(e)	10.06	41.00	41.00
December.....	No record	3.67	4.50	3.74	(e)	6.12	13.00	13.00
Year.....	*25.86		*39.36	*24.00	*35.60	(e)	*44.77	*54.00

MONTH.	LITTLEJOHN SETTLEMENT.		NEWCOMB.		NORTH OSCEOLA.		OTTO MILLS.	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1911.	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	No record	No record	1.69	8.00	No record	No record	No record	No record
February.....	No record	No record	No record	No record	No record	No record	No record	No record
March.....	No record	2.24	20.00	No record	No record	No record	No record	No record
April.....	No record	No record	No record	No record	No record	No record	No record	No record
May.....	(g) 1.23	No record	No record	No record	(h) 1.35	No record	(i) 2.04	No record
June.....	7.88	4.95	6.90	6.90	6.90	7.48	7.48	7.48
July.....	4.79	2.96	2.44	2.44	2.44	3.30	3.30	3.30
August.....	5.13	2.48	5.36	5.36	5.36	3.87	3.87	3.87
September.....	5.66	4.82	4.75	4.75	4.75	3.82	3.82	3.82
October.....	5.32	4.37	5.63	5.63	5.63	4.96	4.96	4.96
November.....	5.56	(e)	2.34	(e)	4.81	30.50	6.74	*5.25
December.....	4.60	2.50	1.50	(e)	5.62	6.50	4.36	3.50
Year.....	*40.17	*2.50	*27.35	*28.00	*36.86	*37.00	*36.57	*8.75

\* Record incomplete.

(a) Established May 16, 1911.

(b) Discontinued November 15, 1911.

(c) Established February 16, 1911.

(d) Established May 19, 1911.

(e) No snow record given.

(f) Established May 18, 1911.

(g) Established May 19, 1911.

(h) Established May 17, 1911.

(i) Established May 19, 1911.

Recorded precipitation at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the year 1911.

MONTH.	PULASKI.		REDFIELD.		ROME.		SMARTVILLE.	
	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.	Rain or melted snow.	Measured depth of snow.
1911.	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
January.....	No record	No record	No record	No record	No record	No record	No record	No record
February.....	No record	No record	No record	No record	No record	No record	No record	No record
March.....	No record	No record	No record	No record	6.04	No record	No record	No record
April.....	No record	No record	No record	No record	2.49	No record	No record	No record
May.....	(x) 1.35		(a) 1.88		2.94		(c) 1.36	
June.....	7.06		6.19		4.42		7.09	
July.....	3.36		3.04		5.27		5.49	
August.....	3.45		4.55		4.33		5.31	
September.....	2.27		4.93		5.89		5.08	
October.....	3.05		5.09		6.43		4.07	
November.....	3.39	(b)	6.36	(b)	5.99	(b)	6.43	(b)
December.....	2.75	1.00	5.36	3.75	3.09	(b)	3.88	(b)
Year.....	*26.68	*1.00	*37.40	*3.75	*46.89	(b)	*38.71	(b)

MONTH.	STILLWATER.	
	Rain or melted snow.	Measured depth of snow.
1911.	<i>Inches.</i>	<i>Inches.</i>
November.....	(d) 2.39	6.68
December.....	2.74	1.00
Year.....	*5.13	*7.68

\* Record incomplete.

(x) Established May 15, 1911.

(a) Established May 17, 1911.

(b) Record not given.

(c) Established May 16, 1911.

(d) Established Nov. 15, 1911.

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Recorded temperatures at the State of New York Conservation Commission rainfall observation stations in the Adirondack Region for the years 1910 and 1911.

MONTH.	FORKED LAKE.			KEEPAWA.			MORRHOUSEVILLE.			NORTH CREEK.		
	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.
1910.												
January	12.1	30.8	21.4	7.8	29.3	18.6	7.2	29.4	18.4	7.8	31.3	19.9
February	4.9	27.4	16.2	1.3	26.1	13.7	3.3	27.3	15.3	4.9	29.1	17.0
March	21.1	44.9	33.0	17.7	45.9	31.8	19.7	45.1	32.5	24.5	47.0	35.8
April	33.4	55.0	44.2	31.2	56.0	43.6	31.1	57.5	44.3	35.7	58.8	47.2
May	41.6	60.5	51.0	37.2	61.0	49.1	35.7	59.5	49.2	42.1	64.3	53.0
June	49.3	68.5	58.9	44.3	71.2	57.8	44.3	70.8	57.6	51.1	72.2	61.6
July	54.3	75.4	64.8	50.8	78.4	64.6	51.7	77.7	64.9	57.8	80.1	68.6
August	52.5	72.6	62.6	48.5	73.6	61.0	49.7	73.6	61.6	59.9	74.2	65.4
September	43.1	65.7	54.4	42.4	66.5	54.4	45.4	67.6	56.5	47.8	66.8	57.5
October	36.4	55.1	45.8	33.6	55.6	44.6	35.0	56.9	46.1	38.0	60.0	48.6
November	25.6	35.9	30.8	22.6	33.8	28.2	24.7	35.0	30.0	28.2	39.6	33.8
December	4.2	25.2	14.7	-0.6	21.8	10.6	2.6	14.7	14.1	5.4	26.4	16.0
Yearly			41.5			38.2			40.9			45.7
1911.												
January	6.2	28.6	17.4	2.3	28.2	15.2	7.7	a30.2	19.2	7.6	31.9	20.0
February	6.2	28.5	17.4	2.2	26.1	14.2	4.5	*	5	7.2	28.5	18.1
March	7.8	35.0	21.4	4.6	34.5	19.6	9.6	*	23.5	14.5	38.1	26.2
April	22.2	48.2	35.2	20.0	47.7	33.8	21.1	45.9	34.8	26.7	52.0	39.4
May	44.2	71.2	57.7	41.0	73.6	57.3	42.5	72.6	57.6	49.1	75.9	62.0
June	48.8	69.4	59.1	46.5	70.4	58.4	46.3	69.9	58.1	52.8	71.6	62.2
July	54.4	78.9	66.6	50.6	80.4	65.5	49.7	79.1	64.4	57.5	81.8	69.6
August	53.4	73.5	63.4	50.2	75.3	62.8	51.0	74.1	62.9	55.8	77.2	66.0
September	44.2	69.1	56.6	41.5	65.1	53.3	42.8	64.9	53.9	46.3	66.7	56.5
October	35.6	54.6	45.1	33.4	53.8	43.6	33.5	54.6	43.8	35.6	51.5	46.5
November	22.3	38.6	30.4	19.7	36.2	28.0	20.7	36.4	28.4	24.7	41.1	32.7
December	19.8	33.7	26.8	18.4	33.1	25.8	19.5	33.3	26.4	23.5	38.5	31.0
Yearly			41.4			39.8			*			

NOTE.— Minima and Maxima are monthly means of each, not absolute temperature.  
\*Record incomplete. (a) Three days missing. (b) Record not given.

Recorded temperatures at the State of New York Conservation Commission rainfall observation stations, in the Adirondack Region, for the year 1911.

MONTH.	WELLS.			NEWCOMB.			ROME.		
	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.
1911.									
January		No record		19.6	34.0	21.8		No record	
February	3.3	31.8	17.6		No record			No record	
March		No record		3.8	35.6	19.7	14.2	34.5	24.9
April		No record			No record		28.9	50.6	39.8
May	46.8	79.6	63.2		No record		49.2	75.6	62.4
June	48.1	77.6	62.8	47.3	70.7	59.0	52.2	74.6	63.4
July	53.3	85.9	69.6	49.5	81.1	65.3	58.5	83.5	71.0
August	51.9	79.9	65.9	44.7	80.6	63.6	57.3	78.9	68.1
September	44.3	70.0	57.1	36.4	70.2	53.3	48.5	70.2	59.3
October	34.1	58.1	46.1	31.8	59.5	45.6	38.7	58.2	48.5
November	22.6	(a)40.1	33.4	23.8	41.5	32.6	25.8	40.5	33.2
December		No record		1.8	26.3	14.0	25.4	37.4	31.4
Yearly			*			*			*

NOTE.— Minima and Maxima are monthly means of each, not absolute temperatures.  
\* Record incomplete. (a) Two days missing.



*Recorded temperatures at the State of New York Conservation Commission rainfall observation stations in the Adirondack Region for the years 1910 and 1911.*

MONTH.	OLD FORGE.			POTSDAM.			TUPPER LAKE.(b)			WANAKONA.		
	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.	Min- imum.	Max- imum.	Mean.
1910.												
January.....	8.1	31.1	19.6	10.0	30.8	20.4	8.4	30.2	19.3	No record		
February.....	0.6	28.6	14.6	6.7	27.5	17.1	1.1	26.2	13.6	No record		
March.....	17.6	46.6	32.1	26.5	47.9	37.2	20.5	46.0	33.2	No record		
April.....	33.2	57.3	45.2	39.2	60.0	49.6	No record			No record		
May.....	40.0	65.1	52.6	43.4	63.5	53.4	No record			No record		
June.....	45.3	74.5	59.9	50.9	73.9	62.4	No record			No record		
July.....	51.8	81.3	66.6	50.2	82.8	66.5	No record			No record		
August.....	50.1	77.7	63.9	47.0	78.1	62.6	No record			No record		
September.....	46.0	70.8	a58.4	36.5	68.6	52.6	No record			No record		
October.....	35.2	57.2	46.2	35.2	60.6	47.9	No record			36.1	56.6	46.4
November.....	24.1	37.6	30.8	28.2	39.2	33.7	No record			25.1	36.5	30.8
December.....	1.0	30.6	15.8	5.7	24.5	15.1	1.6	22.8	12.2	1.2	24.8	12.8
Yearly.....			*41.1			43.2			*			*
1911.												
January.....	6.6	29.8	18.2	5.2	28.7	17.0	16.6	28.7	17.6	5.1	28.8	17.0
February.....	5.0	28.4	16.7	5.4	23.8	14.6	3.5	26.7	15.1	3.6	26.3	15.0
March.....	7.8	36.1	23.0	15.0	37.3	25.8	8.1	38.2	22.2	7.6	32.6	20.1
April.....	21.7	49.8	35.8	29.6	53.8	41.7	22.6	49.2	35.9	22.0	49.8	35.9
May.....	43.4	73.9	58.6	49.3	76.0	62.7	46.0	73.5	59.8	44.4	73.7	59.0
June.....	47.5	71.4	59.4	54.1	75.8	65.0	48.9	71.2	60.0	47.5	72.5	60.0
July.....	52.0	80.1	66.0	61.7	85.3	73.5	53.8	81.7	67.8	a53.7	a84.2	69.0
August.....	50.9	75.0	63.0	58.9	83.0	70.9	51.6	77.4	64.5	52.0	78.3	65.2
September.....	42.7	65.5	54.1	46.4	71.2	58.8	42.0	68.0	55.0	41.3	65.5	53.4
October.....	34.6	54.8	44.7	a39.3	a59.6	49.4	34.5	54.7	44.6	34.8	53.6	44.2
November.....	20.5	39.4	30.0	25.8	41.6	33.7	20.0	36.2	28.1	21.4	36.8	29.1
December.....	19.4	34.3	26.8	25.0	37.2	31.0	19.1	33.6	26.4	21.3	34.3	27.8
Yearly.....			41.3			45.4			41.4			41.3

NOTE.— Minima and Maxima are monthly means of each, not absolute temperatures.

\* Record incomplete.

(a) One day missing.

(b) January, February, and March records taken at Faust. Station re-established in November, 1910, at Tupper Lake village.

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**APPENDIX B.**

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**DISSENTING OPINION.**

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**[163]**



and improvement

cannot be passed unnoticed  
plan for the conservation of the

**APPENDIX.** The question has been carefully  
reports relating thereto presented to the

The views of the Commission upon the subject  
as 238 to 248 inclusive of its report for the year 1909,

**STATE OF** inclusive of its report for the year 1910 and in its con-  
ses 70 to 74 inclusive of its last annual report, to wit: that

where it again recommended the passage of a law providing for  
general and systematic development of the water powers of the State  
for the public use and benefit. The testimony given at the hearing in this  
case failed to convince me of any error expressed in our previous reports.  
The conservation movement has taken such a deep hold upon the public mind  
and is so important to the future welfare of this State that nothing should  
be done to interfere with the real progress in that direction.

If we should proceed with these plans to regulate the flow of the Hudson  
river for the preservation of the public health and safety by building a  
reservoir on the Sacandaga river at Conklingville, it would set back for  
many years the carrying out of any general plan for the conservation of the  
State's natural resources, if not block such a plan altogether.

Nature has fitted a large area of land between Conklingville and North-  
for a storage reservoir. An area of 26,500 acres is spread out in this  
which can be acquired for a reservoir site at a minimum cost. She  
Dissenting opinion of the Commission at Conklingville so close together that a

In the disposition of these proceedings I cannot agree with the majority. Better natural con-  
by a majority of my associates. The proceeding is one to preserve the 29,000,000,000  
health and safety by regulating the flow of the Hudson river. The act, chapter 734 of the Laws of 1904, the law under which these  
proceedings are brought, reads as follows, to-wit: "An act to establish a  
permanent commission for the regulation of the flow of water courses in the  
state in aid of the public health and safety, to be known as the River Improv-  
ment Commission." The prayer of each petition is for regulating the flow  
of the Hudson river in aid of the public health and safety, and the evidence  
given upon the hearing was directed toward that one purpose alone.

In this dissenting memorandum I need not go over the preliminary steps.  
It will be sufficient for the purpose of presenting my views to come squarely  
to the question—what should be done with this application?

The evidence shows that high water in the Hudson river in the spring  
time is a serious menace to the public health and safety in the cities and  
villages of the middle Hudson river valley. It further appears from the  
testimony given at the hearing and from published reports, that practically  
the only cause of this menace is the ice jams which form in the shallow  
channel from Castleton to Stuyvesant. Nothing in all the evidence is more  
clear than the fact that these ice jams are the cause of nearly all the damage  
to property and are the source of the menace to the public health and safety.  
It is also clear that whatever is done to relieve the communities on the  
Hudson from Troy to Castleton of the flood nuisance must include plans for

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ons on the shoals or shallow bottoms from Castleton  
ious omission in this application in not referring  
e is no reference to the subject—no study  
and no plans to relieve that condition  
on these shallow bottoms, even  
and the storage reservoir  
the river of ice jams  
preservation of the  
movements. The  
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the river below the reservoir  
power and increasing the flow of the Hudson  
dry weather period would demand that the reservoir, when  
be held until needed at the wheels of the power owners and to  
the channel from Troy to Coxsackie. These two demands upon the  
ervoir are inconsistent with each other. They cannot stand together.  
advocates of one policy or the other must be disappointed. If 95 per  
cent. of the cost of this improvement is to be assessed upon the power owners  
and only 5 per cent. upon those benefited by reason of a relief from flood  
menace, then certainly those who have contributed 95 per cent. will have a  
right to be heard upon the question of how the stored waters are to be used  
and will be able to present their claim with great force and with much equity.  
The claimants for relief from flood damages will reply by saying that the  
very basis of the act under which we are proceeding is laid on the declaration  
of preserving the public health and safety, and without that purpose there  
would be no constitutional warrant for such proceedings and no authority  
whatever for the condemnation of the lands necessary to carry out the project.  
It seems, therefore, clear that the thought of assessing 95 per cent. of the  
cost of these proceedings upon the power owners must be abandoned, or the  
stored water must be used to its fullest extent for power purposes.

There is another significant fact which came to our attention at the hear-  
ing. It was this, but one municipality and only a few individuals which  
these proceedings seek to benefit appeared in behalf of the application. This  
may have been in the thought that if the dam was built it would be con-  
trolled by the State for the sole purpose of preventing flood damage and only  
incidentally for power purposes. It is, therefore, clear to a minority of

this Commission that under this theory of the case the proposed improvement should be abandoned.

Another question arising in these proceedings cannot be passed unnoticed at this time, that is, a wise and economical plan for the conservation of the possibility of water power in this State. The question has been carefully studied by this Commission and reports relating thereto presented to the Governor and Legislature. The views of the Commission upon the subject will be found at pages 238 to 248 inclusive of its report for the year 1909, at pages 90 to 128 inclusive of its report for the year 1910 and in its conclusions on pages 70 to 74 inclusive of its last annual report, to wit: that of 1911, where it again recommended the passage of a law providing for the general and systematic development of the water powers of the State for the public use and benefit. The testimony given at the hearing in this case failed to convince me of any error expressed in our previous reports. The conservation movement has taken such a deep hold upon the public mind and is so important to the future welfare of this State that nothing should be done to interfere with the real progress in that direction.

If we should proceed with these plans to regulate the flow of the Hudson river for the preservation of the public health and safety by building a reservoir on the Sacandaga river at Conklingville, it would set back for many years the carrying out of any general plan for the conservation of the State's natural resources, if not block such a plan altogether.

Nature has fitted a large area of land between Conklingville and Northville for a storage reservoir. An area of 26,500 acres is spread out in this valley which can be acquired for a reservoir site at a minimum cost. She has also brought the mountains at Conklingville so close together that a great storage dam can be built at a minimum expense. Better natural conditions for the storage of a great quantity of water, namely, 29,000,000,000 cubic feet, to be used seventeen times between Troy and Corinth at the several established power plants, does not exist anywhere in the State. I am impressed with the fact that if this opportunity to build a large storage reservoir and use the stored waters for power purposes is prevented by the granting of this application, it would be a step backward in the march of real conservation of the State's natural resources.

But few laws in many years have had so much time spent upon their preparation or were considered by so many men of distinction as this river improvement law. The great value that can be made of stored waters to water power owners was the force that directed the drafting of the bill which became chapter 734 of the Laws of 1904. At the time the bill became a law there was no way by which the power owners upon the large streams of the State could create a storage necessary to maintain a greater profitable flow in the large rivers for power purposes. The genius and skill shown by those charged with the preparation of the law was of the highest order. They covered the real purpose of the act with a popular governmental function, to wit: "The public health and safety"—they left hidden the true purpose of their work, namely, "The development of water power." As a commission we must not try to evade the issue nor shut our eyes to what is to be accomplished by our approval of the application, for the fact remains that water power will be developed and public safety sacrificed for the profits of power owners.

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I am not convinced that the modification made in the plans by a majority of my associates will accomplish what they intend, but I am convinced that true conservation will be defeated; their modifications will come to naught, the menace to the public health and safety will not be prevented and an opportunity to present to the people of the State a systematic plan for the development of the water power of the State for the public use and benefit will be defeated. Neither am I convinced that the Commission has authority to engraft upon this decision the conditions made in the order of my associates. It seems to me that they have gone beyond the powers of the Commission and entered the field of legislation; that their provisions for modifying the plans and specifications are in the nature of a change in the statute and will not be upheld by the courts.

An order should be entered to the effect that the proceedings be abandoned. President Persons joins in this dissenting opinion.

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**APPENDIX C.**

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**BEFORE THE STATE WATER SUPPLY COMMISSION.**

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## APPENDIX C.

### BEFORE THE STATE WATER SUPPLY COMMISSION.

In the Matter  
of the  
Application of the BOARD OF SUPERVISORS OF  
THE COUNTY OF MONROE to regulate the  
flow of the Genesee river.

*Decision.*

This matter came before the State Water Supply Commission upon the petition of the Board of Supervisors of the county of Monroe under the provisions of chapter 734 of the Laws of 1904, known as the "River Improvement Law", which became sections 10 to 22a inclusive of the "State Boards and Commissions Law".

The preliminary steps and investigations as directed by this law having been made by the Commission, it filed, in the county clerk's office of the counties of Monroe, Livingston, Wyoming and Allegany, the several counties wherein the land affected by the proposed improvements is situate, the preliminary maps showing all such lands, the number of acres in each separate tract and the names of the owners and occupants thereof so far as the said Commission could ascertain them; preliminary plans, specifications and estimates of the total cost of the proposed improvement; a list of the counties, towns, cities, villages and individual properties which in its judgment would be benefited; a preliminary statement of the proportional share of the total cost of the proposed improvements which should be borne by the said counties, towns, cities and villages respectively and the individual owners of property collectively, expressed in decimals. The Commission then directed that a notice of hearing upon the application be published in several newspapers, as the law provides.

The matter came on for hearing at the common council chamber in the City Hall in the city of Rochester on Thursday, February 2, 1911. Mr. G. Y. Webster appeared for the county of Monroe and for the Board of Supervisors of said county; George Eastman appeared for the Rochester Chamber of Commerce; Mr. Punnett appeared for the Civic Conference of Rochester; Charles M. Dow, Edward Hagerman Hall, Henry R. Howland, Prof. A. W. Grabeau and Dr. Mary T. Green appeared personally and by Adelbert Moot, their counsel (Mr. Moot also appeared for the American Scenic and Historic Preservation Society); R. M. Searle appeared for the Rochester

Railway & Light Company; Isaac Budlong appeared for the Water Storage Committee of the Board of Supervisors of Monroe county; Mr. Frost appeared for the Board of Supervisors of Livingston county; H. S. Bacon, special deputy, appeared for the Attorney-General; W. W. Webb, Corporation Counsel, appeared for the city of Rochester; John F. Connor appeared for the Mount Morris Water Power Company and the Genesee River Company; Charles G. Voke appeared for several property owners in the town of Chili.

All of these appearances were in favor of the application, except those represented by Mr. Moot, Mr. Voke and by Deputy Attorney-General Bacon.

The Genesee river rises in Pennsylvania and flows northward across the State of New York into Lake Ontario. It passes through a rich agricultural region and then through the city of Rochester, which owes much of its prosperity to the water power derived from the falls of the river within the city limits.

The river has two drainage areas, separated by a ridge of glacial drift which crosses the valley at Portageville. The area of the upper drainage basin, south of Portageville, is 948 square miles. The drainage area of the lower river between Portageville and Rochester is 1,417.

The flow of the river is extremely variable, ranging at Portage from a minimum of 54 cubic feet per second, in the dry summer months, to from 40,000 to 50,000 cubic feet per second in time of floods.

The inconvenience and loss resulting from this intermittent flow have long been severely felt by the owners of farming lands in the valley, by power owners at Mt. Morris and in the city of Rochester and by municipalities, and for the last twenty years various steps have been taken to devise a plan to regulate and equalize the flow of the river. This demand has arisen from the region north of Portage, which is about seventy-six miles south of Rochester. Between Portage and Rochester there are about 30,000 acres of farm land situated along the river, which is subject to annual inundation by floods. As a result, the use of this land for purposes of cultivation is impaired, while the city of Rochester and individual property owners are subject to serious damages by reason of flood conditions.

The water power developments along the river, especially in Rochester, have found the flow of the river inadequate during the summer to maintain their needed power, and have been obliged, at large expense, either to supplement it by steam power or to supply the deficiency by purchasing electrical power generated at Niagara Falls. The increasing demand for electrical power and the progress of invention in the transformation of water power to this form of energy, have caused an insistent demand for such regulation of the flow of the Genesee river as will provide for the maximum amount of power from the water which flows annually over the falls. This regulation can be accomplished only through the construction of a storage reservoir, or reservoirs, which will impound the surplus water of flood seasons and release it gradually during the summer when the natural flow of the river is at its lowest stage. There is a fall in the river at Portage of about 342 feet, and within three and one-half miles of Portage there is, in the rest of the distance to Mt. Morris, a fall of 174 feet more. In Rochester there is a series of falls and rapids aggregating 250 feet.

## ATTEMPTS AT REGULATION.

The Genesee river many years ago was made by statute a public highway.

In response to the requests of those who desired the equalization of the flow of the river, the State Engineer made several investigations and surveys as far back as 1890, under appropriations provided by the Legislature for this purpose.

Altogether more than \$100,000 of State funds have been expended in this work. In 1895 it was proposed to construct a dam for the ostensible purpose of providing water for the canals, and then to give to the owners of water power an equivalent for the water diverted for canal purposes. The Legislature passed a bill appropriating \$200,000 for the dam, but it was vetoed by the Governor, who failed to find justification for the proposed outlay.

The next attempt to regulate the river took shape in the incorporation by chapter 605, Laws of 1898, of the Genesee River Company, with the idea that the regulation might be brought about by private capital, if a private company could in return obtain the exclusive right to the newly-developed water powers at Portage and elsewhere upon the river below that village. With this in view, broad powers were granted to the Genesee River Company under its charter, but efforts to raise money were not successful, and the company has been unable to meet the requirements of its charter in regard to constructive work. The charter, however, was kept alive by the Legislature, which granted an extension of five years in 1906. This period will expire on July 1, 1911. Largely owing to the failure of this plan, the Legislature passed the present River Improvement Act, which provides, in brief, that the flow of the river may be regulated for the protection of the public health and safety, at local expense, under State supervision. The Legislature in the annual Supply Bill of 1908, chapter 466, appropriated \$25,000 for making surveys upon the river, and for making maps and plans showing the actual conditions and the property that would be benefited by a regulated flow of the river, and directed the State Water Supply Commission to determine whether the flow of the river should be regulated under the River Improvement Act.

## THE PETITION OF THE BOARD OF SUPERVISORS OF MONROE COUNTY.

The Board of Supervisors of the county of Monroe on the 5th day of September, 1908, filed with this Commission a petition for the regulation of the flow of the Genesee river under the provisions of the River Improvement Act. This petition reads as follows:

## "PETITION TO STATE WATER SUPPLY COMMISSION.

*"To the State Water Supply Commission:*

*"The petition of the Board of Supervisors of the county of Monroe, State of New York, respectfully shows:*

*"That the Genesee river, which has its source in Potter county, Pennsylvania, flows in a northerly direction through the counties of Allegany, Wyoming, Livingston and Monroe in this State, and discharges into Lake Ontario, north of the city of Rochester. It has two principal watersheds — the upper*

located south and upstream from Portageville has an area of ten hundred sixty square miles, and the lower located north and down stream from Portageville is much smaller. From Portageville to Mt. Morris, a distance of approximately twenty miles, the river falls five hundred feet, and from Mt. Morris to the feeder dam at Rochester, a distance of thirty-six miles by direct line, it drops only seventy-two feet. In this distance from Mt. Morris to Rochester the river flows back and forth through and across a fertile valley of rich bottom lands comprising upwards of fifty thousand acres, so that the distance by the stream is several times the distance by direct line. From the feeder dam at Rochester to Lake Ontario there is an additional fall in the stream of approximately two hundred sixty-five feet, substantially all of which is within the limits of the city of Rochester.

"That the Genesee river is very irregular in its flow, varying at Portage from sixty-five cubic feet per second at low water time, to fifty thousand cubic feet per second in flood time, and at Rochester from one hundred thirty cubic feet per second at low water time to upwards of fifty thousand cubic feet per second in flood time.

"That the river is subject to frequent floods, on which occasions it overflows its banks and the waters spread out over the aforesaid bottom lands from Mt. Morris to Rochester, to a depth varying from a few inches to several feet, according to the extent of the flood; that the flood waters which cause the river to thus overflow are from the upper watershed. When the river, during flood periods, leaves its channel it frequently flows across country, making a new channel for itself and carrying away fences, buildings and often the soil for a considerable depth from the lands overflowed. During these floods horses, cattle and other domestic animals are overtaken in treacherous places by the rapidly rising waters and drowned, and sometimes human life likewise imperiled. When a flood occurs after seeding time farm crops in Monroe and Livingston counties are damaged to the extent of thousands of dollars, and it often happens that the river overflows at a time when the farm lands in said counties are covered with a heavy growth of vegetation; the waters remain on these lands a sufficient length of time to destroy this vegetation as well as many small wild and domestic animals and with the recession of the waters a decomposition of these dead animals and this vegetable growth sets in producing unsanitary and unhealthful conditions and offering a ready channel for the creation and spread of ptomaine poisoning. The contour of the bottom lands is more or less irregular and with every flood the low places are left filled with water without an outlet or any means of exit other than through absorption by the ground or evaporation by the sun. These stagnant pools, scattered over the valley, sometimes small and sometimes large, become breeding places for mosquitoes and malarial germs, and malarial fever and its train of subsidiary diseases such as rheumatism, neuralgia and anæmia follow.

"In the city of Rochester the flood waters of the river, at high water times, are forced through the sewer pipes into cellars of business places, damaging foundation walls, destroying personal property and producing conditions that jeopardize the safety and health of portions of the city. At times the waters rise to such a height that, with driftwood and ice, a blockade of the channel becomes imminent, endangering both life and property. At other times the

flow of this stream becomes so small that it is entirely insufficient to carry off the sewage discharged therein and the conditions arising therefrom become a menace to the public health and safety.

"That these floods are and for many years past have been of frequent occurrence, and although high waters are of more usual occurrence in spring and early summer this river is subject to flood at all seasons.

"That these floods, occurring as hereinbefore stated, and producing the conditions hereinbefore stated, are a menace to the public health and safety in the city of Rochester and the county of Monroe and throughout the Genesee valley.

"That a regulation of the flow of the Genesee river and a prevention of the flood conditions prevailing thereon are necessary for the protection of the public health and safety.

"That reference is hereby made to the official reports of the State Engineer of the State of New York for the years 1890, 1891, 1893, 1894, 1897, which reports contain certain data and information touching the matters set forth in this petition.

"WHEREFORE, your petitioner prays that the flow of the waters of the Genesee river may be regulated under the provisions of chapter 734 of the Laws of 1904 and the acts amendatory thereof and supplementary thereto, for the protection and preservation of the public health and safety.

"THE BOARD OF SUPERVISORS OF THE COUNTY OF MONROE.

"(BY) H. E. HAMIL."

The State Water Supply Commission acting under the River Improvement Act, and the bill making the appropriation above referred to, as requested by said petition, has made extensive surveys of the Genesee valley from Mt. Morris to Rochester, and made a series of maps showing all the land in the Genesee valley subject to inundation by high water, giving the name of the owner of each parcel, the number of acres in each parcel, the location of the property in the city of Rochester affected by high water, and the names of the owners thereof. It has also prepared plans for a dam to be erected on the most available site above Portage Falls, with the estimated cost thereof and a map showing all the lands that would be flooded by such a dam.

These plans and estimates provide for the construction of a storage reservoir with a dam 152 feet high crossing the narrow strip of Letchworth park. The reservoir, as planned, will be 15 miles long up stream, and will cover an area of  $13\frac{1}{4}$  square miles. It will impound 19,000,000,000 cubic feet of water, and require nearly one year to fill it. The upper 19 feet of the reservoir is intended to arrest ordinary flood waters, and the remainder to impound a sufficient amount of water to maintain a minimum flow in the river of 1,240 cubic feet per second during the dry summer months. In this manner the danger to the public safety from floods will be removed and the unsanitary conditions existing after floods and during the dry summer months, would be corrected. This regulated flow would make it possible, moreover, to develop 30,000 horsepower below the falls, and to add to the plants in the lower river at Rochester 18,000 horsepower.

A survey for relocating the line of the Pennsylvania railroad in the reservoir basin has also been made.

The total cost of building the reservoir, including relocating the Pennsylvania road, is estimated at \$4,588,000 which the law directs the Commission to assess, if the proposed improvement is made, upon the lands benefited. Such assessment the Commission has made as follows: Upon three counties, to wit: Monroe, Livingston and Wyoming, 5 per cent; upon fifteen towns, to wit: Gates, Brighton, Chili, Henrietta, Wheatland, Rush, Caledonia, Avon, York, Geneseo, Leicester, West Sparta, Groveland, Mt. Morris, Castile, 1.5 per cent; upon the city of Rochester, 5 per cent; upon three villages, Avon, Geneseo and Mt. Morris, 2 per cent, and upon individual properties, including corporations, water power plants, etc., 92.8 per cent.

The tentative assessment district includes 1,900 different parcels of property.

In determining the questions involved in this application, it is necessary to refer to previous legislation looking toward the conservation of the natural water resources of the State, and to the work done by this Commission under such legislation.

The Legislature in 1907 passed a bill, known as the Fuller Act (Chapter 569, Laws of 1907), which directed the State Water Supply Commission to investigate water power possibilities throughout the State, with a view to their systematic development in order to produce a revenue to the State under State ownership, supervision and control, in the public interest.

Acting under such direction of the Legislature, the Commission has made extensive studies and surveys upon the Hudson, Sacandaga, Schroon, Raquette, Black, Genesee and other rivers with a view to determine, if possible, upon a plan for a general and systematic development of the water powers of the State for public revenue. A series of maps and plans of each watershed have been made from such surveys and studies, showing how the work of conserving the water powers of the State can be accomplished. These studies, surveys, maps, plans, etc., are set forth and discussed in the reports of the Commission for the years 1908-9-10 and 11. Accompanying the reports for 1910 and 1911 is a draft of a bill recommended for passage by the Commission, which provides the plan for carrying out its suggestions as required by chapter 569 of the Laws of 1910.

The work of the Commission is further shown by a series of more than 2,000 maps and plans, all carefully and systematically labeled and filed in the office of the Commission.

After making a thorough study of the Genesee, both under these acts and under the special appropriation referred to above, the Commission found that for the regulation and development of the Genesee, a storage reservoir should be built at Portage.

The directions to the Commission, by chapter 569 of the Laws of 1907, were so clear and emphatic, that nothing less than the draft of a bill, which would provide for a general and systematic plan for the development of the water powers of the State, would meet its imperative demands. In its report of 1910, at page 27, the Commission expressed the belief that it would be unwise to attempt the regulation of the river under the River Improvement Law.

## PUBLIC HEALTH AND SAFETY.

Preserving the public health and safety are the fundamentals therefor, on which must rest the law under which these proceedings were taken. Unless the sanitary conditions caused by the irregular flow of the river in the Genesee valley and in the city of Rochester are such as to justify the interference of the State, this application must be denied.

The greater part of the evidence given upon the hearing supported the justification of such interference.

Witnesses testified that large areas of flat land between Rochester and Portage are overflowed, almost annually, by floods which bring down the filth and drainage of the upper river, including sometimes the carcasses of dead animals, and deposit such drainage and debris in low spots, thus forming pools of filth and decaying matter to simmer and evaporate in the sun. These flood waters in the years 1865 and 1902 rose so high as to flood the streets of the city of Rochester. The evidence did not show that human lives had been lost in any of these floods, but it was contended that at any day a flood might occur, unless means should be taken to control the surplus water, which would cause fatal disasters in Rochester.

It was also shown by witnesses that the present flow of the river through Rochester during the dry months of summer, is insufficient to carry off the sewage discharged into the river bed from dwellings situated upon the banks, and that this sewage collects in pools in the river bed, poisoning the adjacent air.

Physicians testified that the pools of stagnant water left behind by the floods upon the flat lands above Rochester, and the pools of sewage in the river bed within the city limits of Rochester were a menace to health, in that they were breeding places for flies and mosquitoes which were disseminators of malaria, typhoid fever and a variety of intestinal diseases.

This testimony was uncontradicted, but the opposition contended that it did not show a menace to the public health and safety within the meaning of the State Boards and Commissions Law, upon which the proceeding was based. Assuming that the sanitary and health conditions in the locality affected are such as to warrant the Commission in going forward with this improvement, it is brought face to face with the question, can it be carried forward under this law.

## LETCHWORTH PARK.

This application is complicated by the existence of Letchworth park. Below Portage the river plunges over three cataracts of rare scenic beauty. The late William Pryor Letchworth, a man of great public spirit, purchased these falls and about one thousand acres of land adjoining them on the west bank of the river, which land he converted into a park. Becoming alarmed at the broad grant made to the Genesee River Company, giving it the right to divert the water from these falls, Mr. Letchworth offered to convey this land to the State, subject to his life tenancy, upon condition that the State should forever maintain it as a park. The State accepted the gift by chapter 1, Laws of 1907, which reads as follows:



## " CHAPTER I.

"AN ACT to accept a deed of gift from William Pryor Letchworth, bachelor, to the people of the State of New York, of land in the town of Genesee Falls, Wyoming county, and the town of Portage, Livingston county, this State.

" Became a law, January 24, 1907, with the approval of the Governor. Passed, three-fifths being present.

*" The People of the State of New York, represented in Senate and Assembly, do enact as follows:*

"Section 1. The people of the State of New York hereby accept title to the lands mentioned in the deed of gift or conveyance now in possession of the Governor of this State, which deed was executed the thirty-first day of December, nineteen hundred and six, by William Pryor Letchworth, bachelor, to the people of the State of New York, conveying to them certain lands situate in the town of Genesee Falls, Wyoming county, and the town of Portage, Livingston county, in this State, which lands are more fully identified and described in said deed, being about one thousand acres of land, upon which the grantor now resides. Title to such lands is accepted upon the terms and conditions stated in said deed, namely, that the land therein conveyed shall forever be dedicated to the purpose of a public park or reservation, subject only to the life, use and tenancy of said William Pryor Letchworth, who shall have the right to make changes and improvements thereon. The action of the Wyoming Benevolent Institute, a corporation organized by chapter four hundred and seventy-nine of the laws of eighteen hundred and seventy, in conveying to William Pryor Letchworth all its lands in the town of Genesee Falls, Wyoming county, included in and described as a part of the lands so conveyed by William Pryor Letchworth to the people of the State of New York by a deed executed on the thirty-first day of December, nineteen hundred and six, is hereby ratified and confirmed, so as to give said deed the same force and effect as if such action of the Wyoming Benevolent Institute had been expressly authorized by law before the execution of said deed. All lands described in and covered by said deed of William Pryor Letchworth shall be deemed to be in the actual possession of the Comptroller of this State, subject to such life use and tenancy of said grantor. After the death of the grantor, the American Scenic and Historic Preservation Society shall have control and jurisdiction thereof for the purposes stated, unless the Supreme Court shall determine otherwise for good cause shown upon application of the Comptroller, or some other duly authorized official of the State.

"Section 2. This act shall take effect immediately."

Mr. Letchworth conveyed the property to the State by a deed, dated December 31, 1906.

Upon Mr. Letchworth's death in December, 1910, the American Scenic and Historic Preservation Society, in accordance with the law, became custodian of the park.

As a result of the various investigations and surveys, it became known that the best and most economical site for the dam of the proposed storage reservoir was about one thousand feet above the upper fall of the river in Letchworth

park. In order to prevent the construction of a dam there, and the consequent possible diversion of water from the falls through a proposed tunnel, or power development works, in the park, Mr. Letchworth purchased a narrow strip of land about one hundred feet wide, extending two thousand feet south along the shores of the river and including the river bed at the point where the location of the dam had been fixed, and he made this strip a portion of Letchworth park. Therefore, it becomes necessary to consider carefully the objections to these plans, arising because of these facts and conditions.

The American Scenic and Historic Preservation Society, and owners of property near Portage, arrayed themselves against the project upon the ground that to build a dam across any part of Letchworth park would be a violation on the part of the State of the contract made with Mr. Letchworth when it accepted the deed of his property for park purposes. The deed conveying this park to the State contains the condition that the property shall be forever dedicated to park and reservation purposes, and the act accepting the park ratifies and confirms this condition.

This strip of land has no special beauty, neither does it add to the attractiveness or charm of the park proper. The proposed dam, if built, will cross the narrow strip about 500 feet above the Erie railroad bridge, and completely submerge the remaining 500 feet of the narrow strip.

It must also be conceded that in order to justify the execution of the proposed plan, and the assessment of a large proportion of the cost thereof upon power that might be developed at the falls, the stored water, except a minimum flow of 150 cubic feet per second during the daylight hours, must be diverted from the natural river channel into a conduit carried around the park, to be used in developing electrical power below the falls. Such a diversion of the water of the river, it is claimed by those opposing this project, is a direct violation of the provisions of the Letchworth deed and also that such a diversion could be prohibited by injunction proceedings.

It is clear that the dam could be so built and the face of the wall so finished and decorated as to make it a thing of massive grandeur. The reservoir created above the park made an attractive lake and as much water permitted to flow over the falls during the daylight hours as usually flows over them during the summer and fall months.

The question then arises, will the use of the land in this manner and a diversion of the greater part of the water from its natural channel through the park be a violation of the trust and contract. If it would, then the building of the proposed dam is prohibited, unless the State is willing that the park and gift of Mr. Letchworth shall revert to his heirs, or be subject to an action by the American Scenic and Historic Preservation Society, the present custodian of the park, to permit such use.

The American Scenic and Historic Preservation Society, and other persons, insist with much force and learning that it would defeat the trust, while the petitioners contend with equal force and ability that the building of the dam at the point proposed, although it will completely cover the north part of this narrow strip of land, will not defeat the conditions of the trust. These opposing parties also made the following other objections, to wit:

First, that no menace to the public health and safety has been satisfactorily shown, and therefore the Commission has no jurisdiction to proceed.

Second, that the main purpose of the petition was to bring about the development of water power, and that the Commission has no authority to issue bonds or lay assessments upon property for that purpose.

Although the River Improvement Law, as passed, and this application as presented, are for the preservation of the public health and safety, the fact remains that both the purpose of the law and the application have linked these proceedings with water power development. This point is emphasized by the fact that the admitted costs of the enterprise make its execution impossible without the payment of the major per cent of the total cost by water power owners.

It is conceded by those interested in the development of water power on the Genesee river, that regulating the flow thereof as planned would result in largely increasing the power at the plants already in operation. At Rochester an all year round flow of 1,240 cubic feet per second would make it possible to develop at these plants 18,000 additional horsepower; it is also possible to install a power plant below the falls at Portage which would develop 32,000 horsepower.

The value of this additional 50,000 horsepower, which probably can be developed by reason of regulating the flow of the river, besides abating the high water nuisance, would doubtless amount to \$200,000 a year. The plans themselves contemplate using the top nineteen feet of the dam for flood control and the balance for power and summer flow. It is, therefore, clear that the water power owners should pay the larger per cent of the cost of this proposed regulation.

The tentative assessment made by the Commission levies 7.2 per cent upon the municipalities and 92.8 per cent on the property owners.

These owners consist of the farmers in the valley, the business people in the city of Rochester and the power owners.

As no evidence was given upon the hearing to show any error in the Commission's tentative assessment, it is to be assumed that it was fair to all interested.

The next question which presents itself is, what proportion of the cost of the project—estimated at \$4,588,000—shall be borne by the farm lands and city property benefited and what portion by the power owners. The Commission cannot escape a serious consideration of this division of costs. These properties and water rights ought to be accurately bounded and clearly and legally defined. As to the boundaries of the farms and city lots which are to become a part of the proposed tax district, no question can be raised as to their metes and bounds and location. Can as much be said of the water power rights? Is the evidence at all clear what those rights are, and who the owners are? Is the question as to who shall be assessed free from doubt? Are we sure that the rights of the Genesee River Company can be assessed for the value of 30,000 all-the-year-round horsepower that can be developed at the falls below Portage? Are the rights and the interests of the several owners of water power in the city of Rochester so well known that the Commission acting under this law can make an assessment that will be binding? All of these questions *must have* an affirmative answer if this petition is to be granted.

The only information given to the Commission at the hearing as to the rights of the owners of the water power in the city of Rochester and the

separate interests therein, was the evidence of R. M. Searls, vice-president of the Rochester Railway & Light Company. His testimony contains many cogent reasons for a regulated flow of the Genesee river. He also said that the company he represented expects to pay its just share of the total costs of regulating the flow of this river. His testimony was both clear and frank as to the general benefits to the power owners and to the city of Rochester, and as to the willingness of his company to pay its share. But there is scant, if any, evidence to show what his company's rights are. Those rights must be very clearly fixed, and their increased value by reason of the regulated flow determined, before a just assessment can be made.

Replying to questions by Mr. Bacon who represented the Attorney-General, Mr. Searls said his company had certain rights in the Brown & Seymour race, but that he had never "dug up the titles". And again he said his company owned rights in all the races, 87 per cent in all, but nowhere does it appear who are the owners of the other interests. In some instances the Rochester Railway and Light Company owns the water rights separate from the land, and in some cases the rights were acquired with the land.

#### GENESEE RIVER COMPANY.

The rights of the Genesee River Company add another difficult question to this problem. What are its rights? Are they sufficiently definite to levy a tax upon? To be sure, it is a valid corporation with rights to build dams, install power plants and distribute electricity. While it has a legal existence at the present time, it is liable to have its charter annulled by the State for failure to comply with the terms of its charter. Its officers may say that if the prayer of this petition is granted it will go forward and install, below the falls at Portage, upon the land upon which it holds an option, a power plant of the maximum capacity. But there is nothing to prevent the same officers from saying at the very next meeting that such a development cannot be made. In such a case, what can be levied on? Merely a *right* to do something. How far would the proceeds from a sale of the right of the Genesee River Company to do something go toward paying the costs of building the proposed dam?

The testimony of Mr. Connor before the Commission was frank and manly, but it did not make clear how much stable property the Genesee River Company would add to a tax district to secure a bond issue of \$4,588,000.

#### INTERESTS OF THE STATE.

The law provides that the State must pay its proportionate share of the cost of a storage dam, if any benefits accrue to it. Therefore, the State's rights and interests should be known. What are they? Even Mr. Bacon, representing the Attorney-General, although generally clear and lucid in his statements, left us very much in doubt as to the rights and interests of the State and to the policy of the department he represented.

All of the value of added power to the plants at Rochester and the value of the possible power that can be developed at new power sites by reason of a regulated flow, must be called upon to pay its just share of the total costs. When that is done, if it can be, the value of the stored waters from the

regulated flow of the Genesee river practically passes into the hands of the water power owners. They will say, as they will have a right to, "it is ours, we paid for it, none should interfere with our profits from or enjoyment of it".

Can we afford to stretch the River Improvement Law to such an extent? Can we afford to permit the rights of the State to the water power on the river to be wiped out? Can the city of Rochester afford to have the value of the regulated flow of the river which has contributed so much to its prosperity, pass from the State to the corporation which now controls 87½ per cent of the water rights on the river? We think not. Cannot the farmers in the Genesee valley, the real property owners in the city and the city itself well afford to await the passage of a law as recommended by the State Water Supply Commission or a wiser one that will provide for a general and systematic development of the water powers of the State for the general welfare?

Nothing short of State ownership and control of the undeveloped great reservoir sites, to use for the present, and to preserve for the future that which belongs to the future, measures up to the demands of this generation.

This Commission has spent a great amount of time and a large amount of money in studying the subject; it has expressed its opinion upon the economical importance of real State conservation and the value of such a step to the prosperity of this commonwealth.

To give its consent to the application of the petition in this matter, surrounded as it is with so many objectionable questions, would be a disregard of our previously expressed opinion, and to overlook the demands which the conservation movement has made upon our age.

On account of the impracticability of regulating the flow of the Genesee river and making the assessments for the cost thereof under the river improvement act, and the wider objection that an attempt to conserve the water powers of the State under such narrow limits will impede the greater movement in behalf of a general systematic development of such power for the general welfare, this application is denied.

MILO M. ACKER,  
JOHN A. SLEICHER,  
ROBERT H. FULLER,

*Commissioners.*

Dated, June 16, 1911.

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**APPENDIX D.**

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**DECISION ON WATER SUPPLY APPLICATIONS, JAN-  
UARY 1, TO SEPTEMBER 30, 1911.**

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## APPENDIX D.

### DECISIONS OF THE COMMISSIONS ON WATER SUPPLY APPLICATIONS.

The following table contains a list of the applications filed with this Commission and the State Water Supply Commission since the creation of the latter, together with the disposition made of each case:

No.	Applicant.	Date of Filing.	Disposition.
1.	City of New York.....	Nov. 3, 1905.	Approved May 14, 1906.
2.	City of Kingston.....	Nov. 8, 1905.	Discontinued.
3.	City of Oneida, . . . . .	Dec. 2, 1905.	Approved March 16, 1906.
4.	Village of Lyons Falls.....	Dec. 26, 1905.	Approved March 28, 1906.
5.	Village of Constableville.....	Dec. 30, 1905.	Approved April 19, 1906.
6.	City of Watervliet.....	Jan. 25, 1906.	Dismissed Sept. 25, 1906.
7.	Village of Millbrook.....	Feb. 21, 1906.	Withdrawn Mar. 5, 1906.
8.	Village of White Plains.....	Apr. 20, 1906.	Approved June 15, 1906.
9.	City of Lockport.....	May 24, 1906.	Approved July 13, 1906.
10.	Village of Malone.....	June 28, 1906.	Approved Jan. 18, 1907.
11.	Village of Holland Patent.....	Aug. 25, 1906.	Approved Sept. 25, 1906.
12.	Village of Brewster.....	Oct. 12, 1906.	Approved Feb. 21, 1907.
13.	Village of Bergen.....	Oct. 18, 1906.	Approved Nov. 8, 1906.
14.	City of Gloversville.....	Nov. 27, 1906.	Approved Jan. 18, 1907.
15.	Village of Carthage.....	Dec. 13, 1906.	Approved March 14, 1907.
16.	Hannacroix Water Co.....	Dec. 22, 1906.	Approved Oct. 17, 1907.
17.	City of Plattsburg.....	Jan. 19, 1907.	Approved Feb. 27, 1907.
18.	Village of Pleasantville.....	Feb. 9, 1907.	Approved Aug. 6, 1907.
19.	Village of Seneca Falls.....	Feb. 21, 1907.	Approved Oct. 16, 1907.
20.	Village of Waterville.....	Mar. 6, 1907.	Approved May 9, 1907.
21.	Village of Old Forge.....	Mar. 13, 1907.	Approved May 9, 1907.
22.	Village of Ossining.....	Mar. 13, 1907.	Approved Nov. 26, 1907.
23.	Village of Peekskill.....	Mar. 15, 1907.	Discontinued.
24.	Urban Water Supply Co.....	May 22, 1907.	Approved July 16, 1907.
25.	Village of East Aurora.....	June 13, 1907.	Approved July 18, 1907.
26.	Martinsburg Water District.....	July 2, 1907.	Approved July 15, 1907.
27.	City of New York — Modification of Catskill Aqueduct line.....	July 12, 1907.	Approved Oct. 15, 1907.
28.	City of New York — Schoharie watershed . . . . .	July 12, 1907.	Discontinued.
29.	City of Rome.....	July 20, 1907.	Approved Aug. 15, 1907.
30.	Tannersville Water Co.....	Aug. 23, 1907.	Approved Dec. 21, 1907.
31.	Great South Bay Water Co.....	Dec. 14, 1907.	Approved Jan. 21, 1908.



No.	Applicant.	Date of Filing.	Disposition.
32.	City of Gloversville (second application) . . . . .	Jan. 16, 1908.	Approved Feb. 18, 1908.
33.	Village of McGrawville . . . . .	Jan. 20, 1908.	Approved March 11, 1908.
34.	Village of Malone . . . . .	Feb. 12, 1908.	Discontinued.
35.	Village of Bainbridge . . . . .	Feb. 20, 1908.	Discontinued.
36.	Staatsburg Water Co. . . . .	Mar. 6, 1908.	Approved April 10, 1908.
37.	Village of Briarcliff Manor . . . . .	Apr. 18, 1908.	Discontinued.
38.	Palenville Water District . . . . .	July 16, 1908.	Petition not completed.
39.	Harmon Water Co. . . . .	Apr. 27, 1908.	Withdrawn Sep. 16, 1908.
40.	City of New York — Suffolk county sources . . . . .	July 29, 1908.	Pending.
41.	Village of East Syracuse . . . . .	July 30, 1908.	Approved Aug. 14, 1908.
42.	Edmeston Water Co. . . . .	Aug. 14, 1908.	Approved Sept. 16, 1908.
43.	Village of Marcellus . . . . .	Aug. 24, 1908.	Approved Sept. 30, 1908.
44.	Village of Shortsville . . . . .	Oct. 5, 1908.	Approved Feb. 6, 1909.
45.	Village of Clifton Springs . . . . .	Oct. 5, 1908.	Approved Oct. 14, 1908.
46.	Village of Webster . . . . .	Nov. 23, 1908.	Approved Dec. 12, 1908.
47.	Syracuse Suburban Water Co. . . . .	Dec. 1, 1908.	Approved April 9, 1909.
48.	Village of White Plains (second application) . . . . .	Dec. 30, 1908.	Approved Nov. 30, 1909.
49.	City of Glens Falls . . . . .	Mar. 6, 1909.	Approved April 21, 1909.
50.	City of New York — Nassau county sources . . . . .	Mar. 12, 1909.	Approved May 15, 1909.
51.	Village of Bainbridge (second application) . . . . .	Mar. 16, 1909.	Approved Aug. 18, 1909.
52.	Fultonville Water Co. . . . .	Mar. 17, 1909.	Combined with No. 57.
53.	Village of West Carthage . . . . .	Apr. 7, 1909.	Approved April 22, 1909.
54.	Rensselaer Water Co. . . . .	Apr. 12, 1909.	Approved April 21, 1909.
55.	City of Niagara Falls . . . . .	Apr. 20, 1909.	Approved July 14, 1909.
56.	Village of Webster (amended application) . . . . .	May 5, 1909.	Approved June 15, 1909.
57.	Village of Canajoharie . . . . .	June 1, 1909.	Approved March 10, 1910.
58.	Village of Croghan . . . . .	June 17, 1909.	Approved Sept. 22, 1909.
59.	Village of Mechanicville . . . . .	June 22, 1909.	Approved July 13, 1909.
60.	Central Bridge Water Co. . . . .	July 2, 1909.	Approved July 29, 1909.
61.	Whitney's Point Water Co. . . . .	July 8, 1909.	Approved July 30, 1909.
62.	Water District of Town of Petersburg . . . . .	July 15, 1909.	Approved Oct. 14, 1909.
63.	Village of Livonia . . . . .	July 16, 1909.	Approved Oct. 21, 1909.
64.	Village of Mt. Morris . . . . .	Aug. 2, 1909.	Discontinued.
65.	Village of Painted Post . . . . .	Aug. 18, 1909.	Approved Sept. 3, 1909.
66.	Village of Farmingdale . . . . .	Sept. 22, 1909.	Discontinued.
67.	City of New York — Modification of Catskill Aqueduct . . . . .	Dec. 16, 1909.	Approved Oct. 7, 1910.
68.	Village of Barker . . . . .	Jan. 11, 1910.	Discontinued.
69.	Jamaica Water Supply Co. . . . .	Jan. 13, 1910.	Approved Feb. 15, 1910.
70.	Village of Pike . . . . .	Feb. 3, 1910.	Approved March 10, 1910.
71.	Village of Keeseville . . . . .	Mar. 4, 1910.	Approved May 25, 1910.
72.	Otisville Water District . . . . .	Apr. 4, 1910.	Approved Nov. 30, 1910.

No.	Applicant.	Date of Filing.	Disposition.
73.	Village of Spencerport.....	Mar. 23, 1910.	Approved May 10, 1910.
74.	City of Plattsburg.....	Mar. 24, 1910.	Denied May 20, 1910.
75.	Village of Croton-on-Hudson....	Apr. 6, 1910.	Approved Aug. 24, 1910.
76.	Harrison Water District No. 1..	Apr. 18, 1910.	Approved May 20, 1910.
77.	Greenwich Union Water Works Co. ....	Apr. 29, 1910.	Approved May 11, 1910.
78.	Village of Black River.....	May 3, 1910.	Approved May 20, 1910.
79.	Belfast Water District.....	May 26, 1910.	Approved July 7, 1910.
80.	Village of Moravia.....	July 6, 1910.	Approved Aug. 24, 1910.
81.	Village of Canajoharie.....	July 13, 1910.	Approved Aug. 10, 1910.
82.	Village of Youngstown.....	July 20, 1910.	Approved Aug. 24, 1910.
83.	City of Hornell.....	Aug. 4, 1910.	Approved Aug. 24, 1910.
84.	Village of Silver Springs.....	Aug. 12, 1910.	Approved Nov. 3, 1910.
85.	City of Ithaca.....	Aug. 22, 1910.	Approved Oct. 7, 1910.
86.	Roslyn Water District.....	Aug. 17, 1910.	Approved Oct. 25, 1910.
87.	Village of Cherry Creek.....	Sept. 6, 1910.	Approved Oct. 7, 1910.
88.	Andes Water Co.....	Sept. 12, 1910.	Approved Oct. 7, 1910.
89.	Village of Oriskany Falls.....	Oct. 11, 1910.	Approved Nov. 3, 1910.
90.	Summerville Water District....	Oct. 20, 1910.	Withdrawn Oct. 28, 1910.
91.	John A. Drew.....	Oct. 28, 1910.	Approved Dec. 29, 1910.
92.	Village of Angola.....	Dec. 7, 1910.	Approved Dec. 29, 1910.
93.	Village of Avoca.....	Jan. 25, 1911.	Approved Feb. 10, 1911.
94.	Westbury Water District.....	Feb. 21, 1911.	Approved April 7, 1911.
95.	Weedsport Water Co.....	Mar. 1, 1911.	Approved March 22, 1911.
96.	City of Gloversville.....	Apr. 26, 1911.	Approved June 16, 1911.
97.	Village of Cornwall.....	May 24, 1911.	Approved June 6, 1911.
98.	City of Cortland.....	June 17, 1911.	Approved July 11, 1911.
99.	Castle Heights Water Co.....	July 6, 1911.	Approved Sept. 25, 1911.
100.	Village of Mexico.....	Aug. 12, 1911.	Pending.
101.	N. Y. City, Borough of Rich- mond .....	Sept. 12, 1911.	Pending.
102.	N. Y. City, Borough of Brooklyn	Sept. 12, 1911.	Pending.
103.	Manhasset-Lakeville Water Dis- trict .....	Oct. 24, 1911.	Approved Dec. 20, 1911.

**APPLICATION NO. 57.****BEFORE THE STATE WATER SUPPLY COMMISSION.**

In the Matter  
of the  
Application of the VILLAGE OF CANAJOHARIE  
for a new and additional source of water  
supply.

Present: Henry H. Persons, President; Charles Davis, John A. Sleicher, Ernst J. Lederle and Milo M. Acker, Commissioners.

**OPINION.**

The village of Canajoharie situate on the southern bank of the limestone region of the Mohawk river, filed with this Commission on the first day of June, 1909, a petition asking for the approval of its maps, plans and profiles for a new and additional source of water supply.

Accompanying the petition were maps and plans, a report of its engineer and an analysis of a sample of the water it proposed to take and a sheet of the United States Geological survey showing the quadrangle in which the village and source of proposed water are situate.

Objections to the application of the village were filed by Charles H. Groff, Solon A. Groff, Water Supply Company of Canajoharie and The Fultonville Water Company; Jeremiah Saltsman, Sydney Palmatier, James H. Cross, George Nellis and later in the proceedings objections were also filed by the bondholders of the Water Supply Company of Canajoharie.

The matter came on for hearing in the Opera House Block, in the village of Canajoharie, the 18th day of June, 1909, pursuant to a notice duly given under the rules of the Commission.

Proof of publication of the notice of the hearing was filed.

Newton J. Herrick, Esq., appeared as counsel for the village; Charles E. Schultze, chairman of the municipal board, also appeared for the village; Andrew J. Nellis, Esq., appeared for the Water Supply Company of Canajoharie and the Fultonville Water Supply Company; Mr. H. L. Lark, Esq., appeared for the bondholders of the Water Supply Company of Canajoharie.

Upon the hearing a large number of documents were put in evidence and a vast amount of testimony given by the applicant to substantiate its claim, all of which has been considered by the Commission.

Canajoharie is an incorporated village with a population of 2,400, an assessed valuation of \$1,035,030 and a bonded indebtedness of \$34,800.

In this region all of the water available for a municipal supply, whether underground or surface, is so very hard that it is only used for domestic purposes when soft water is unobtainable.

The village is now supplied with water by the Water Supply Company of

Canajoharie, a private corporation which furnishes water under a contract made with Joseph M. Johnson, dated August 17, 1909, and assigned by Johnson, with the consent of the village, to the Water Supply Company of Canajoharie, on the 18th day of November, 1901. This company takes its water for the village from an underground source known as Null Springs located within the village limit and pumped into a reservoir with a capacity of only 53,000 gallons, situate at an elevation of about 200 feet above the business portion of the village but only a few above a number of the dwelling houses therein. While the pressure is adequate for fire purposes and domestic use in the lower part of the village, it is not sufficient to afford either adequate fire protection or satisfactory pressure for domestic use to that portion of the village which is located on the hillsides at an elevation in some instances nearly as great as the reservoir itself.

The system of distributing pipes of the Water Supply Company of Canajoharie extends to nearly all parts of the village and is worth many thousand dollars to the company and, to the village, if it should purchase the present plant of the company and make it a part of its own municipal system. Should that be done, it would save disturbing the streets, lawns and yards where pipes are now laid and, it would also save to the village the loss which would result from the competition that would follow the establishment and operation of a new municipal plant by the village before it could hope to connect its own system with all of the water users of the village, and also the expense to individuals of making new connections.

If the quantity of the water supplied by the present company was sufficient, or if the quality was such as to commend it for domestic use, or if the elevation of the reservoir at the present time was high enough to produce sufficient pressure, the objections of the Water Company in the matter, would carry weight, but as the quantity of the water which the company furnishes during that season of the year when there should be an abundance, is insufficient, and as the quality of the water furnished is not soft enough to make its use attractive for domestic purposes, and as the pressure is not sufficient for either fire protection or domestic use, it is clear, that the village authorities are justified in making an effort to improve the municipal water supply, in all of these three essentials.

The plan of the officials of the village is to obtain a future supply from springs issuing from the foot hills of the Adirondack mountains where an abundance of pure, soft and odorless water can be obtained and at a cost which the village can well afford to pay.

These springs are situated in the towns of Ephratah and Johnstown, Fulton county, and have a combined flow of 1,664,008 gallons per day of 24 hours as shown by weir measurements. Either of two of these springs will deliver to an aqueduct line a sufficient quantity of pure, soft and odorless water to meet the present needs of the village. The watershed of these springs is practically uninhabited and partially covered with forest growth. It is, therefore, easy and inexpensive to remove all objectionable buildings from the watershed and reforest with evergreens such portion as is not at the present time growing timber.

The village proposes to purchase these springs and their entire drainage area and to protect them from all possible contamination. The water is to

be conducted direct from the springs by a pipe line to a distribution reservoir in or near the village at such an elevation as will give ample pressure for both fire protection and for domestic consumption. From this reservoir water will be distributed through the piping system of the present water supply company which the village proposes to purchase. There will be added to the plant purchased from the present company such necessary improvements as will make it when connected with the new source of water supply, an up to date municipal plant which will materially add to the comfort of its citizens and to the prosperity of its business interests.

After an examination of the local situation and a study of the evidence given at the hearing, it is clear to the Commission that the village of Canajoharie has established the fact that its application for a new and additional source of water supply is justified by public necessity.

Canajoharie has by an election of the duly qualified electors held as provided by the village law, voted to raise by taxation \$150,000 or so much thereof as may be necessary for the purpose of installing a municipal water plant, to be owned and controlled by the village. This sum as shown by the evidence given on the hearing is ample to complete the plant proposed in the application of the petitioner, and pay all damage, both direct and indirect, that will be caused thereby. By this act of the village, the authorities have been given power to raise a sufficient sum of money to carry their proposed project into effect. The plan of the village is to purchase the land necessary, by agreement if possible and if not, to take it by condemnation proceedings, which is a fair and equitable way of determining the damages to all persons and property and making payment therefor.

The taking of the waters from these springs which unite to form Sprite creek, will not interfere in any manner with any other municipality or civil division of the State or with the inhabitants thereof, considering both their present and future necessities for sources of water supply. There are no municipalities that rely upon these springs for water for municipal purposes, neither will the growth of any municipality situate in the region of these springs be liable, even in the distant future, to require them for any municipal purpose whatever.

Upon considering all of the local conditions and facts connected with this application but one conclusion can be reached, that is, that the application of the petitioner should be granted.

The State Water Supply Commission therefore determines:

First: That the plans proposed by the petitioner herein are justified by public necessity.

Second: That such plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third: That such plans make fair and equitable provision for the determination and for the payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans.

The State Water Supply Commission hereby approves the plans and the maps of the lands to be acquired by the village of Canajoharie for a new and additional source of water supply and the profiles thereof showing the

sites and areas of the proposed reservoir and their works, the plans and surveys and the plan or scheme for the determination and payment of all damages to persons or property, whether direct or indirect, which will result from the execution of said plans.

IN WITNESS WHEREOF, the State Water Supply Commission hath caused this determination and approval to be signed by the Commission, and caused its official seal to be affixed hereto, and the [L. S.] same, with all maps, plans, surveys, and other papers relating thereto to be filed in its office in the city of Albany, this 10th day of March, 1910.

HENRY H. PERSONS,  
*President.*

MILO M. ACKER,  
JOHN A. SLEICHER,  
CHARLES DAVIS,  
*Commissioners.*

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**APPLICATION NO. 93.**

STATE OF NEW YORK — STATE WATER SUPPLY COMMISSION.

<p>In the Matter</p> <p>of the</p> <p>Application of the Trustees of the village of Avoca, acting as the Board of Water Commissioners of that village, for approval by the State Water Supply Commission of the petitioner's plan to acquire additional watershed for the purpose of protecting its water supply.</p>	}	<p><i>Decision.</i></p>
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On the 25th day of January, 1911, the village of Avoca, by its village trustees, acting as the board of water commissioners of said village, filed with the State Water Supply Commission a petition praying the Commission to take suitable proceedings and grant to the petitioners the right, power and authority to acquire 2.13 acres of land upon which are located certain springs which now supply the village with water. The map showing the location and extent of the land to be acquired was duly filed with the Commission and on the 10th day of February, 1911, the Commission gave a hearing pursuant to notice duly published as required by law, at the town house, in the village of Avoca, Steuben county, N. Y., at 10 A. M. The petitioners appeared

by their attorney, Burton W. Sly, and the objectors, Mr. and Mrs. Fay Wessels, were represented by their attorney, Reuben R. Lyon.

The petition of the applicants and the evidence adduced at the hearing showed that the existing water supply is satisfactory in all respects except that it is subject to surface contamination. The petitioners desire to acquire the lands on which the springs are situated in order that the springs may be properly protected from such contamination.

The village of Avoca was duly incorporated as a village upon application made December 6, 1883. It has a population of about 1,100 and the water supply is furnished from springs situated on the property of the village and on the Wessels' farm about 1½ miles west of the village. The village owns about sixty acres of land adjacent to the source of water supply, but does not own the particular parcel upon which the springs are situated. These springs, being on a side hill, the water flows on the surface or seeps through to the lands owned by the petitioners, where it is collected in a spring house, from which it passes through a pipe to a concrete reservoir whence it is distributed by a gravity system through six-inch and eight-inch mains to the village. The prevailing water pressure is approximately fifty pounds to the square inch. There are about thirty-six fire hydrants so distributed that no house is over 500 feet from a hydrant. The quality of water is generally satisfactory as shown by analyses made by the laboratories of the State Health Department. The rates charged for water are \$1.00 per year for the first tap and fifty cents per year for each additional tap. The income from this source amounts to from \$500 to \$550 per annum. The indebtedness of the village is limited to a bonded debt of \$18,000 for this water supply system and the income from water rentals is about equal to the interest on the bonds. There is no maintenance or operating expense connected with the operation of the water works system, the operation of valves and inspection of the springs being attended to by village officials having other duties to perform.

It is clear from the evidence presented that public necessity requires that the village acquire this parcel of land on which the springs are situated in order that its source of water supply may be properly protected from contamination. It is also evident that the village has in its treasury sufficient money to pay for the lands to be acquired, the price having been stipulated at the hearing before this Commission. It is further evident that no indirect damages will result from the acquisition of the lands by the petitioner. No other municipality or civil division of the State is affected by this petition since it would be impracticable for any neighboring municipality or civil division to utilize this source of water supply.

The State Water Supply Commission, therefore, finds and determines:

First, that the plans of the applicant for a new source of water supply are justified by public necessity.

Second, that the plans of the applicant are just and equitable to other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third, that said plans make fair and equitable provision for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans, or the acquiring of said lands.

The Commission, therefore, approves the plans of the applicant and grants the application.

IN WITNESS WHEREOF, the State Water Supply Commission hath caused this determination and approval to be signed by the Commission, and caused its official seal to be affixed hereto, and the same, with all maps, plans and other papers relating thereto, filed in its office in the city of Albany, this 20th day of February, 1911.

HENRY H. PERSONS,  
*President.*

MILO M. ACKER,  
CHARLES DAVIS,  
JOHN A. SLEICHER,  
ROBERT H. FULLER,  
*Commissioners.*

**APPLICATION NO. 94.**

**STATE WATER SUPPLY COMMISSION OF NEW YORK.**

In the Matter

of the

Application of the WATER COMMISSIONERS OF  
THE WESTBURY WATER DISTRICT for the  
approval of its maps, plans and profiles  
for a source of water supply.

**Appearances:**

J. E. Downing, Esq., for petitioner;  
Henry A. Uterhart, Esq. and H. E. Hawxhurst, Esq., for objectors.  
Decision April 7, 1911.

The Westbury Water District was established by order of the town board of the town of North Hempstead, Nassau county, on February 9, 1911, and on the same day Thomas J. McCord, George W. Lascelle and John Scally were duly appointed as commissioners for the district, and thereafter duly qualified as such.

The petition herein was made by the commissioners of the district on February 16, 1911, filed February 21, 1911, and on February 21, 1911, notice of a public hearing was given, to be held at Fireman's Hall in the village of Westbury on the 7th day of March, 1911.

Prior to the hearing and on March 4, 1911, Robert D. Winthrop, a resident and tax payer of the district, filed objections to the project proposed by the application, in that the plans were not justified by public necessity, were not just and equitable to himself and others similarly situated; that no provision was made for serving any territory included in the district north of the Jericho turnpike; that the maximum amount to be expended would be ex-



hausted in constructing the system as proposed, thereby precluding any further extension of the system into the territory north of Jericho turnpike, and that the area of benefit by the proposed water supply was unreasonably and inequitably smaller than the area of taxation.

The district as established by the town board has an area of  $4\frac{1}{4}$  square miles, is situate wholly within the town of North Hempstead and outside of any incorporated village. It embraces what is known as the village of Westbury (not incorporated), which is a station on the main line of the Long Island Railroad Company and a large surrounding territory. The Jericho turnpike divides the district from north to south in practically equal portions.

South of the turnpike is the village of Westbury, with a population of about fifteen hundred. This section is laid out into village lots, blocks and streets, the principal streets being paved, curbed and guttered. There are many residences and stores, a bank, post-office, hotels, public schools and seven churches, and here reside about 95 per cent. of the property owners of the district. Less than one-half of the total assessed value of the district is situated here.

North of the Jericho turnpike, the situation is entirely different. The land is held in large tracts, constituting country estates, on which are large country houses and out buildings, such as usually accompany such establishments. There are only twenty-five families. No business is conducted there and no land development contemplated. The population is only about 150, but the assessed value of the property is more than one-half of the total assessed value of the water district.

Considering the district in its entirety as established by the town board on the petition of a great majority of the taxable inhabitants, though no owner holding land entirely north of the Jericho turnpike signed the petition, there is a population of 1,639 and an assessed value of \$972,913. There is no public water supply, the residents depending upon individual wells and cisterns, nor is there any fire protection whatever, the Hook and Ladder Company in the village and one small chemical engine and about 200 feet of hose, having on several occasions in the past year proved grossly inadequate.

The plans as originally filed with the Commission provided for an adequate supply of water for domestic use and fire protection to the greater part of the territory lying south of the Jericho turnpike, but none whatever to that part of the district north of this road.

Though it clearly appears that the project to establish a public water supply for the district is justified by public necessity, still it cannot be said that a plan which contemplates service to very much less than the whole district is to the interest of the applicant or the inhabitants of the territory, constituting the water district. The statute relating to the establishment and maintenance of water districts (Town Law, sections 282 to 298, inclusive) is not as explicit as it might be. It, however, intends that the supply of water shall at least be reasonably available to all the inhabitants of the district who are charged with taxation for its establishment and maintenance. The attention of the commissioners of the water district was called to the statute creating the State Water Supply Commission as amended by Chapter 285 of the Laws of 1910, which provides that the Commission "shall \* \* \* either approve such application and plans as presented or with such modifi-

cations in the application and plans submitted as it may deem necessary to protect the water supply and the interests of the applicant or of the inhabitants of the territory supplied by it with water," and thereupon pending the conclusion of the hearings in this matter a modification of the pipe line was made and filed by the commissioners of the water district so as to make the supply of water for both domestic and fire protection available to all the inhabitants of the district, and it was shown that the maximum amount of \$60,000, that can be expended by the district, was amply sufficient to meet the cost of the modification.

In the final form in which this application is now before us, it has the approval of this Commission and it also appeared from the testimony taken at the hearing that the modifications have the approval of the inhabitants of the district north of the Jericho turnpike and obviate their objections.

This Commission, therefore, finds and determines:

First, that the plans proposed by the Westbury water district are justified by public necessity.

Second, that such plans are just and equitable to other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third, that said plans make fair and equitable provisions for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans, or the acquiring of said lands.

The Commission does, therefore, approve the plans submitted and grant the application of the petitioner.

IN WITNESS WHEREOF, the State Water Supply Commission hath caused this determination and approval to be signed by the Commission, and caused its official seal to be affixed hereto, and the same, with all plans, maps and other documents relating thereto, filed in its office in the city of Albany, this 2d day of May, 1911.

HENRY H. PERSONS,

*President.*

CHARLES DAVIS,

MILO M. ACKER,

JOHN A. SLEICHER,

ROBERT H. FULLER,

*Commissioners.*

**APPLICATION NO. 95.****STATE OF NEW YORK — STATE WATER SUPPLY COMMISSION.**

In the Matter  
of the  
Application of the WEEDSPORT WATER COM-  
PANY for approval of its plans for a new  
and additional source of water supply.

*Decision.*

Application filed March 1, 1911.

Hearing March 14, 1911.

Decision March 22, 1911.

The Weedsport Water Company is a corporation organized under the Transportation Corporations Law of the State of New York, having its principal office in the city of Auburn, N. Y. It was organized in 1895 for the purpose of supplying water to the village of Weedsport, having a population of 1,500 inhabitants, and later acquired the stock and bonds, and thus the plant of the Jordan Water Company, so supplying the 1,100 inhabitants of the village of Jordan. The principal source of supply is a gravity supply from springs located midway between Weedsport and Jordan. There is also an auxiliary supply obtained from artesian wells by pumping.

Two reservoirs of 1,000,000 gallons capacity each have been constructed, one near the village of Weedsport and the other near the village of Jordan. During the continued drought of the past three years the present sources of supply have proved inadequate, and it is proposed to utilize the flow of other springs located on a tract of land containing 4.17 acres situated just outside the eastern limits of the corporation of Weedsport. According to the sworn statement of the president of the company these springs have been purchased by Mr. Franklin P. Tabor, president and owner of a large portion of the bonds of the company, and Mr. Geo. P. Harrington; a well and pumping plant constructed, and the supply thus tested.

The Weedsport Water Company has the following liabilities:

Bonds outstanding due June 1, 1911.....	\$45,000
Interest on bonds due and unpaid.....	3,000
Note dated December 1, 1910 and interest to April 1st.....	2,754
Total . . . . .	<u>\$50,754</u>

The owners of the property from which the new supply is to be taken propose to turn over the entire property to the company for \$2,500 either in cash or bonds.

To meet all these obligations and furnish funds for some extensions, the company proposes to issue \$55,000 of refunding bonds to run fifteen years at six per cent.

Chemical and bacteriological examinations show that, although hard, the water is exceptionally pure.

No direct or indirect damages not provided for will occur.

The State Water Supply Commission therefore determines:

(1.) That the plans proposed by the Weedsport Water Company are justified by public necessity.

(2.) That such plans are just and equitable to the other municipalities and civil divisions of the state affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

(3.) That the said plans make fair and equitable provision for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans.

The State Water Supply Commission does hereby approve the map of the lands to be acquired by the Weedsport Water Company for a new or additional source of water supply and the profiles thereof showing sites and areas of the proposed reservoirs and other works, the profile of the aqueduct lines and the flow lines of the waters when impounded, plans, surveys, and abstracts of official reports relating to the same, and the plan or scheme to determine and provide for the payment of the proper compensation for any and all damages to persons or property, whether direct or indirect, which will result from the acquiring of the said lands and the execution of said plans.

IN WITNESS WHEREOF, the State Water Supply Commission hath caused this determination and approval to be signed by the Commission, and caused its official seal to be affixed hereto, and the same, with all plans, maps, surveys, and other papers relating thereto, filed in its office in the city of Albany, this 22nd day of March, 1911.

HENRY H. PERSONS,  
*President.*

ROBERT H. FULLER,  
JOHN A. SLEICHER,  
MILO M. ACKER,  
CHARLES DAVIS,  
*Commissioners.*

**APPLICATION NO. 96.**

STATE OF NEW YORK — STATE WATER SUPPLY COMMISSION.

In the Matter  
of the

Application of the BOARD OF WATER COMMISSIONERS OF THE CITY OF GLOVERSVILLE, N. Y., for permission to obtain the right, either by purchase or condemnation, to adopt, appropriate and take certain lands lying in the Port and Rice creek watersheds, in the town of Johnstown, county of Fulton, New York.

*Decision.*

Petition filed April 26, 1911.

Hearing, June 1, 1911.

Decision, June 16, 1911.

The city of Gloversville has a municipal water system under the control and management of its board of water commissioners. By this system it supplies the inhabitants of Gloversville with water for drinking and other domestic purposes and, as a necessary part of said system, it has various storage reservoirs located in the hill country in the vicinity of the city. This system constitutes the only source of water supply except that furnished by the Kingsborough Water Works Company, a private corporation which supplies that part of the city formerly known as the village of Kingsborough. The chief source of the municipal supply is from the Port and Rice creeks, mountain streams fed by springs. Above the city's reservoirs in these watersheds there are approximately 1,600 acres, chiefly mountainous lands, of which the city now owns about 800 acres and desires to take, by the present application, some 550 additional acres. During the past two or three years, summer camps, without proper sanitary arrangements, have been installed on sections of this area and as all the drainage from these camps must ultimately reach the waters of either Port or Rice creeks, it is evident that the waters of said creeks will become polluted and the purity of the water supply of the city of Gloversville endangered. It is evident that these lands are important and necessary to the city of Gloversville, inasmuch as the waters of Port and Rice creeks flow into and supply the Rice creek storage reservoir, which is the main storage reservoir of the city and its reliable supply in case of drought and low water conditions. The taking of these additional lands will eliminate sources of possible pollution of the streams and the purity of the waters now supplied to the city will be maintained.

No objections were filed or made to this application, though upon the hearing a large number of the owners of the lands proposed to be taken were present or represented by counsel.

We think it may be safely stated, that whatever a municipality undertakes to do to eliminate contamination from its water supply and to maintain its

purity, is in line with its duty to its citizens and especially where, as in this instance, the work is justified by public necessity.

No other municipalities or civil divisions of the State will in any way be affected by the execution of the proposed plans of the petitioner, nor do they affect in any way the property and rights of the Kingsborough Water Works Company.

This application should be granted and approval of the maps and profiles for the additional source of water supply of the city of Gloversville should be made.

The State Water Supply Commission, therefore, finds and determines:

First, that the plans of the applicant are justified by public necessity.

Second, that the plans are just and equitable to other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third, that said plans make fair and equitable provisions for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans, or the acquiring of said lands.

The Commission, therefore, approves of the plans of the applicant.

IN WITNESS WHEREOF, the State Water Supply Commission has caused this determination and approval to be signed by the Commission and caused its official seal to be affixed hereto, and the same, with all maps, plans, surveys and other papers relating thereto filed in its office in the city of Albany, this 16th day of June, 1911.

HENRY H. PERSONS,  
*President.*

JOHN A. SLEICHER,  
MILO M. ACKER,  
CHARLES DAVIS,  
ROBERT H. FULLER,  
*Commissioners.*

**APPLICATION NO. 97.**

BEFORE THE STATE WATER SUPPLY COMMISSION.

<p style="text-align: center;">In the Matter</p> <p style="text-align: center;">of the</p> <p>Application of the VILLAGE OF CORNWALL for a new and additional source of water supply.</p>	<p style="font-size: 3em;">}</p> <p><i>Decision.</i></p>
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The application and papers connected with this proceeding were duly filed with the Commission on the 24th day of May, 1911.

By resolution of the Commission, July 6th at 2 o'clock in the afternoon at Cornwall was fixed as the day, time and place for a hearing on the application. The Commission met in Matthiesen Hall at the time appointed. Mr. John H. Clarkson, the president of the village, Mr. E. B. Talbot, clerk of the village, and Mr. C. L. Waring, attorney for the village, appeared upon behalf of the village. There were no appearances in opposition to the application, neither were there any objections filed with the Commission. Members of the Commission, having visited the location of the proposed new reservoir and examined the surroundings, heard the testimony at this hearing.

The village of Cornwall has owned its water supply for many years; it has a bonded indebtedness of about \$59,000. A sinking fund of \$19,000 has been accumulated solely from the profits of the water department. The past year \$4,000 was added to the sinking fund from the net revenue of the water plant. During very dry seasons the plant, as at present developed, will not supply sufficient water for the needs of all the inhabitants and customers of the village.

This application asks for permission to go about a mile farther up the watershed, acquire about fifteen acres of land for the reservoir site and build a new storage reservoir. The country surrounding this reservoir site is mountainous, wholly wooded with no inhabitants or dwellings upon the watershed at all and no likelihood of there being any for many years to come. The site that has been selected is an ideal one and one against which no objection could be raised. The plan of the village is to issue bonds, buy and pay for the site and pay for any and all damages, either direct or indirect that may result from acquiring the lands and building the reservoir.

There is no other municipality upon the watershed that will be injured by building the proposed reservoir, neither are there any water powers or rights, as appeared from the evidence, that will be affected, except one or two small powers which were bought and paid for at the time the original plant was installed. It is clear, from the testimony given upon the hearing, that the building of this proposed reservoir will provide a sufficient quantity of water for many years for the village of Cornwall. The analysis of the water, as shown upon the hearing, shows it to be of the best quality, and as there is no possibility of contamination, it seems to the Commission that it is an ideal project and one to be commended by this village.

The Commission, therefore, finds and determines:

First, that the plans proposed by the village of Cornwall are justified by public necessity.

Second, that such plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third, that said plans make fair and equitable provisions for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans, or the acquiring of said lands.

The Commission, therefore, approves of the plans of the applicant for a new and additional source of water supply.

IN WITNESS WHEREOF, the State Water Supply Commission has caused this determination and approval to be signed by the Commission and caused its official seal to affixed hereto and the same with all plans, maps, surveys and other papers relating thereto, filed in its office in the city of Albany, this 16th day of June, 1911.

HENRY H. PERSONS,  
*President.*

MILO M. ACKER,  
CHARLES DAVIS,  
JOHN A. SLEICHER,  
ROBERT H. FULLER,  
*Commissioners.*

**APPLICATION NO. 98.**

**STATE OF NEW YORK — STATE WATER SUPPLY COMMISSION.**

In the Matter  
of the

Application of the CITY OF CORTLAND by and through the CORTLAND WATER BOARD for permission to acquire lands for the prevention of the contamination of the water supply and for the approval of its maps and profiles.

*Decision.*

Application filed June 17, 1911.

Hearing, June 27, 1911, at Cortland, N. Y.

Decision, July 11, 1911.

This is an application by the city of Cortland to acquire title to nine parcels of real property, containing in all 63.966 acres for the purpose of preventing pollution of the water furnished by it to its inhabitants. These lands lie within the watershed of the source of supply, adjoin the property from which the supply is directly taken and are partly within and adjacent to the city limits.

Upon several of these parcels are positive and openly apparent causes of pollution and upon others are possible sources of pollution, especially if the water plant should be required to furnish any addition to its present output.

In 1910, upon one parcel, a camp of 125 men, women and children was



maintained during the canning season, within a few rods of the only open water there was upon the property. Use of this water was made by the people of the camp for almost every possible purpose, on another parcel open ditches run from a barnyard and stable directly into the water course, and on another, a cemetery is closely approaching the line of the watershed.

We have repeatedly held in similar applications to this that it was the duty of those charged with furnishing a pure and wholesome supply of water to eliminate every possible source of contamination and plans for this purpose have always had approval.

This application comes within this rule and meets with our approval. No objections were filed, no other municipality or civil division of the State is affected and no cause for indirect damage was shown to exist.

The city of Cortland has a present population of upward of 12,000. The assessed value of the property in the city is about seven millions of dollars and the city has the ability to pay full value for the lands to be taken.

The application is, therefore, approved.

The State Water Supply Commission, therefore, finds and determines:

First, that the plans of the applicant are justified by public necessity.

Second, that the plans are just and equitable to other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Third, that said plans make fair and equitable provisions for the determination and payment of any and all damages to persons and property, both direct and indirect, which will result from the execution of said plans, or the acquiring of said lands.

IN WITNESS WHEREOF, the State Water Supply Commission has caused this determination and approval to be signed by the Commission and caused its official seal to be affixed hereto, and the same, with all maps, plans, surveys and other papers relating thereto filed in its office in the city of Albany, this 11th day of July, 1911.

HENRY H. PERSONS,  
*President.*

CHARLES DAVIS,  
ROBERT H. FULLER,  
*Commissioners.*

**APPLICATION NO. 99.**

STATE OF NEW YORK — CONSERVATION COMMISSION.

<p>In the Matter</p> <p>of the</p> <p>Application of the CASTLE HEIGHTS WATER COMPANY for permission to acquire additional lands for an additional water supply, and for protection of its present supply.</p>	<p>Decision.</p>
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Application filed July 6, 1911.

Hearing July 28, 1911.

Decision September 25, 1911.

This is a proceeding had upon the application of the Castle Heights Water Company, filed July 6, 1911, with the State Water Supply Commission, as required by article II of the State Boards and Commissions Law, for permission to acquire about 7.905 acres of additional land for the purpose of increasing its supply of water to certain of the inhabitants of Westchester county hereinafter named.

On July 12, 1911, subsequent to the filing of the application, chapter 647 of the Laws of 1911, known as the Conservation Law became a law. The members of the Conservation Commission qualified for duty under the Conservation Law July 21st. In the meantime the State Water Supply Commission had set July 21st as the date of the hearing, and due publication thereof was made in the *Daily Reporter* of White Plains. The hearing then set was adjourned to July 28th. Pursuant to said adjournment the Conservation Commission met at the corporation rooms, No. 12 Grand street, White Plains, N. Y., for the purpose of hearing all persons and municipalities affected by the application.

No objections were filed and no one appeared in opposition.

John M. Digney, Esq., appeared for the applicant.

Proof of publication of notice of hearing was duly furnished.

The petition and testimony show that the Castle Heights Water Company is a domestic corporation, duly incorporated under chapter 219 of the Laws of 1909, constituting chapter 63 of the Consolidated Laws and known as the Transportation Corporation Law; that said corporation is the owner of a tract of land situate in the town of Greenburgh, whereon are eight driven wells about one hundred feet deep and pumping machinery connected with piping to the water supply system of the village of White Plains; that the said corporation has entered into contract with the water commissioners of the village of White Plains, with the North White Plains Land Company and with the New York Central Railroad for supplying water; that the said company has under consideration the supply of the city of Mt. Vernon in case of extreme drought; that the water is of good quality and that the

proposed increase in supply is necessary to meet the contract requirements and necessities of the communities and persons served by said company.

The evidence shows that the water bearing strata are overlaid with an impervious layer and that the water is under slight pressure when not being pumped. The quality of the water, despite the proximity of the Bronx river, is further evidence of natural protection from surface contamination.

The water is secured from an underground source. This does not interfere with the supply of any municipality or other civil division of the State. The testimony shows that the applicant is in a satisfactory financial condition.

The Conservation Commission, therefore, determines:

First, that the plans proposed are justified by public necessity.

Second, that said plans provide for proper and safe construction of all work connected therewith.

Third, that said plans provide for proper protection of the supply from contamination and there is natural filtration.

Fourth, that said plans are just and equitable to the other municipalities and civil divisions of the State affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply.

Fifth, that said plans make fair and equitable provision for the determination and payment of any and all legal damages to persons and property, both direct and indirect which will result from the acquiring of said lands.

The application is, therefore, approved.

IN WITNESS WHEREOF, the Conservation Commission has made and signed this decision and caused its official seal to be affixed hereto, and has filed the same, with all maps, plans, surveys and other papers relating thereto in its office in the city of Albany, this 25th day of September, 1911.

GEO. E. VAN KENNEN,  
*Chairman.*

(Seal.)

JAMES W. FLEMING,  
JOHN D. MOORE,  
*Commissioners.*

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## APPENDIX E.

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EXCERPTS FROM CHAPTER LXV OF THE CONSOLIDATED LAWS KNOWN AS THE CONSERVATION LAW AS RELATING TO THE DIVISION OF INLAND WATERS.



## APPENDIX E.

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### EXCERPTS FROM CHAPTER LXV OF THE CONSOLIDATED LAWS KNOWN AS THE CONSERVATION LAW AS RELATING TO THE DIVISION OF INLAND WATERS.

AN ACT relating to conservation of land, forests, waters, parks, hydraulic power, fish and game constituting chapter sixty-five of the consolidated laws.

Became a law July 12, 1911, with the approval of the Governor. Passed, three-fifths being present.

*The People of the State of New York, represented in Senate and Assembly, do enact as follows:*

### CHAPTER LXV OF THE CONSOLIDATED LAWS.

#### CONSERVATION LAW.

- Article 1. Short title (§ 1).
2. Department of conservation (§§ 2-14).
  3. General provisions (§§ 20-25).
  4. Lands and forests (§§ 50, 51).
  5. Fish and game (§§ 150-178).
  6. Hydraulic development (§§ 400, 401).
  7. River improvement (§§ 450-467).
  8. Drainage (§§ 480-491).
  9. Water supply (§§ 520-525).
  10. Laws repealed; when to take effect; saving clause (§§ 550-552).

#### ARTICLE I.

##### SHORT TITLE.

Section 1. Short title.

Section 1. **Short title.** This chapter shall be known as the Conservation Law.

## ARTICLE 2.

## DEPARTMENT OF CONSERVATION.

- Section 2. Conservation department.
3. Office and official force.
  4. Divisions.
  5. Eligibility.
  6. Quorum and meetings.
  7. Duties of certain officers.
  8. Counsel to commission.
  9. Suits and prosecutions.
  10. Pending actions and proceedings.
  11. Employees to continue.
  12. Reports.
  13. Rules and regulations continued.
  14. Power to administer oaths.

§ 2. **Conservation department.** The conservation department is hereby created and shall have three divisions. The department shall be in charge of a commission to be known as the conservation commission which, except as otherwise provided in this chapter, shall have all the powers and be subject to all the duties of the forest purchasing board, the forest, fish and game commission or commissioner, the commissioners of water power on Black river and the state water supply commission as now fixed by law. The commission shall consist of three members to be appointed by the governor by and with the advice and consent of the senate, one of whom designated by the governor shall act as chairman of the commission until a new designation shall be made. The governor may remove a commissioner for inefficiency, neglect of duty or misconduct in office, giving to him a copy of the charges against him and an opportunity of being publicly heard in person or by counsel in his own defense upon not less than ten days' notice. If such commissioner shall be removed the governor shall file in the office of the secretary of state a complete statement of all charges made against such commissioner and his findings thereon, together with a complete record of the proceedings. The regular term of office of a commissioner shall be six years to be computed from the expiration of the terms of the commissioners first appointed under this act, and vacancies shall be filled by appointment for the unexpired term. Within

ten days from the time this chapter shall take effect there shall be appointed three commissioners, one to take office for a term to end on the first day of December, nineteen hundred and twelve; one for a term to end on the first day of December, nineteen hundred and fourteen, and one for a term to end on the first day of December, nineteen hundred and sixteen. Each commissioner shall receive an annual salary of ten thousand dollars and shall have reimbursed to him all actual and necessary traveling and other expenses and disbursements incurred or made by him in the discharge of his official duties.

§ 3. **Office and official force.** The commission shall have its principal office in the city of Albany. The commission shall appoint a secretary to the commission, who shall hold office during the pleasure of the commission and who shall receive an annual salary of three thousand five hundred dollars and shall have reimbursed to him all actual and necessary traveling and other expenses and disbursements incurred or made by him in the discharge of his official duties. The commission shall appoint a chief engineer, who shall hold office during the pleasure of the commission and who shall receive an annual salary of seven thousand dollars and shall have reimbursed to him all actual and necessary traveling and other expenses incurred or made by him in the discharge of his official duties. The commission shall appoint a counsel to the commission, who shall be an attorney and counselor-at-law of the state and who shall hold office during the pleasure of the commission and who shall receive an annual salary of seven thousand dollars and shall have reimbursed to him all actual and necessary traveling and other expenses and disbursements incurred or made by him in the discharge of his official duties. The commission shall appoint three deputy commissioners, who shall each hold office during the pleasure of the commission and who shall receive an annual salary of three thousand five hundred dollars and shall have reimbursed to him all actual and necessary traveling and other expenses and disbursements incurred or made by him in the discharge of his official duties. The commission shall appoint such engineers, clerks and other employees as shall be authorized as follows: The commission shall, on or before the first day of September in the year nineteen hundred and eleven and thereafter on or before the first day of February annually, submit in writing to the governor a list of all positions in the department not herein



expressly provided for, deemed necessary for the conduct of the work of the department, specifying the salaries and compensation deemed necessary and reasonable for each position and, when approved by the governor and filed in the office of the comptroller, the same shall be established and fixed as so approved and no additional positions shall be created and no such salaries and compensation shall be increased except by the approval of the governor in writing so filed. Each commissioner and deputy and the secretary shall execute and file with the comptroller a bond to the people of the state in the sum of ten thousand dollars, with sureties to be approved by the comptroller, conditioned for the faithful performance of his duties, and that he will account for and pay over pursuant to the law all moneys received by him.

§ 4. **Divisions.** There shall be in the department a division of lands and forests under which shall be administered all laws relating to tree culture and reforestation by the state and to the care and management of such parks, reservations or lands of the state as now are or hereafter shall be placed under the jurisdiction of the commission; a division of inland waters under which shall be administered all laws relating to state jurisdiction over water storage and hydraulic development; water supply; river improvement; drainage; irrigation and navigation of waters outside the canals; and a division of fish and game under which shall be administered all laws relating to state jurisdiction over fish and game and for the propagation thereof, including shellfish.

§ 5. **Eligibility.** No person shall be eligible to or shall continue to hold the office of commissioner, deputy commissioner, secretary, chief engineer or counsel to the commission who is engaged in the business of lumbering in any forest preserve county or who is engaged in any business in the prosecution of which hydraulic power is used or in which water is distributed or sold under any public franchise or who is an officer or holder of the stock or bonds of any corporation engaged in such business within the state.

§ 6. **Quorum and meetings.** A majority of the commissioners shall constitute a quorum for the transaction of any business, for the performance of any duty or for the exercise of any power, and meetings may be held at any time or place within the state. Any investigation, inquiry or hearing which the commission has power

to undertake or to hold may be undertaken or held by or before any commissioner. All investigations, inquiries, hearings and decisions of a commissioner shall be and be deemed to be the investigations, inquiries, hearings and decisions of the commission and every order made by a commissioner, when approved and confirmed by the commission and ordered filed in its office, shall be and be deemed to be the order of the commission. The commission shall have an official seal.

§ 7. **Duties of certain officers.** The duties of one deputy commissioner to be designated by the commission shall relate to the division of lands and forests; the duties of one deputy so designated shall relate to the division of inland waters and the duties of one deputy so designated shall relate to the division of fish and game, and each deputy shall have such other and further duties as may be imposed upon him by the commission. The secretary to the commission, the chief engineer and the other officers, engineers and employees of the department, except as specially prescribed in this act, shall have such powers and shall perform such duties as shall be assigned or required of them by the commission.

§ 8. **Counsel to the commission.** It shall be the duty of the counsel to the commission to advise the commission and each commissioner when so requested in regard to all matters in connection with the powers and duties of the commission and of the members thereof and generally to perform all duties and services as counsel to the commission which may be reasonably required of him.

§ 9. **Suits and prosecutions.** It shall be the duty of the attorney-general, when requested by the commission, to appoint a deputy attorney-general, who shall receive an annual salary of five thousand five hundred dollars and assign such deputy to the service of the commission. It shall be the duty of such deputy, in the name of the attorney-general, to conduct all prosecutions for penalties imposed by the forest, fish and game law or by this act and to bring all actions, suits or other proceedings which the commission shall be authorized to institute and maintain and to defend all actions, suits and proceedings brought against the commission, and such deputy, and such assistants as he shall require, to be appointed hereafter by the attorney-general, shall be compen-

sated out of the appropriation to be made by law for the office of the attorney-general. No such suit, action or proceeding and no prosecution for any of the penalties aforesaid shall be begun by said deputy except upon the order of the commission, and the same shall be discontinued when ordered by the commission, and the commission shall have power in its discretion to compromise prosecutions for penalties and judgments for penalties on such terms and for such amounts as the commission deems advantageous to the state. No action, suit or proceeding in which the title to lands of the state in forest preserve counties shall be involved shall be withdrawn or discontinued nor shall judgment therein against the state be entered on consent except on special permission of the court and after application made in open court on which application all the terms and conditions of the settlement shall be fully stated in writing and the reasons therefor set forth at length.

§ 10. **Pending actions and proceedings.** All suits and proceedings brought upon the order of or against the forest, fish and game commission, the commissioners of water power on Black river, the state water supply commission or the forest purchasing board shall be continued by or against the conservation commission and all proceedings pending before the state water supply commission at the time this chapter takes effect shall be continued before the conservation commission but the forest, fish and game commission, the state water supply commission and the forest purchasing board and the commissioners of water power on Black river shall continue as now constituted until the appointment and qualification of the members of the conservation commission to be appointed pursuant to this chapter at which time the forest purchasing board shall cease to exist and the terms of office of the forest, fish and game commissioner and of the members of the state water supply commission and the commissioners of water power on Black river shall expire and thereafter the conservation commission shall be deemed and held to constitute a continuation of the forest purchasing board, the forest, fish and game commission, the state water supply commission and the commissioners of water power on Black river and not a new commission for the purpose of succession to all the rights, powers, duties and obligations for the forest purchasing board, the forest, fish and game commission, the state water supply commission, and the commissioners of water power on

Black river except as modified by this act, with the same force and effect as if such modification were made without any change in the membership of such commission.

§ 11. **Employees to continue.** The appointees and employees of the forest purchasing board, the forest, fish and game commission, the state water supply commission and the commissioners of water power on Black river shall continue in their respective offices and employment until the appointment and qualification of their successors or the abolishment of their positions under the authority of this chapter and without change in respect to the classification of their positions or of their status under the civil service law. On termination of the forest purchasing board and of the offices of the forest, fish and game commissioner and of the members of the state water supply commission and of the commissioners of water power on Black river, the official records, maps and papers and all other public property under their control shall be turned over to the conservation commission.

§ 12. **Reports.** The chief executive officer of each division of the department shall annually report to the commission the proceedings thereof with a statement of its financial transactions and the commission shall annually report to the legislature on or before January fifteenth specifying the receipts, expenditures and work of the department for the preceding fiscal year. It shall be the duty of the commission to publish and distribute for public information reports in which shall be briefly set forth the work of the department and of its several divisions.

§ 13. **Rules and regulations continued.** The rules and regulations duly adopted by the forest, fish and game commission or commissioner or by the state water supply commission and the commissioners of water power on Black river shall continue in full force and effect until otherwise ordered by the conservation commission.

§ 14. **Power to administer oaths.** Each commissioner or deputy commissioner shall have power to administer oaths in any proceeding which he is required or authorized by law to institute or conduct.

## ARTICLE 3.

## GENERAL PROVISIONS.

## Section 20. General jurisdiction.

21. Systematic plan.
22. Dams and other structures in streams; penalties.
23. Actions to recover penalties.
24. Powers of commission on investigations.
25. Immunity of witnesses.

§ 20. **General jurisdiction.** The conservation commission shall have power, for the state, to initiate and conduct, of its own motion, any proceeding provided for in any article of this chapter for the construction of improvements or development of natural resources, for the public health or safety or welfare, or any of them, and if a petition is presented by any person or persons or by a corporation, municipal or otherwise, under any such article, the commission may, in its discretion, extend the scope of such proceeding to and including any or all improvements or developments of natural resources which may be done under all or any provision or provisions of this chapter, and if any part of the procedure governing the matters concerning which the petition is presented cannot be made applicable in all respects to the subject matter of the proceeding as thus extended, then the procedure peculiar to such additional matters as provided for in this chapter shall be adopted to the extent necessary.

§ 21. **Systematic plan.** It shall be the duty of the commission to continue investigations of the water resources of the state, including the systematic gaging of rainfall and stream flow throughout the state, so as to complete a comprehensive system for the entire state, for the conservation, development, regulation and use of the waters in each of the principal watersheds of the state with reference to the accomplishment of the following public uses and purposes:

1. The prevention of floods and the protection of the public health and safety in the watershed.
2. The supply of pure and wholesome water from the watershed to municipalities and the inhabitants thereof and the disposal of sewage.
3. Drainage and irrigation.
4. The development, conservation and utilization of water power in the watershed and to create a revenue for the state.
5. The protection of the public right of navigation.

It shall be the duty of the commission to investigate the possibilities of improving and extending navigation in rivers, lakes and other water courses and bodies of water, outside the canal system in each such watershed, including an investigation into the character of such waters and the use thereof for navigation and with the view of collecting data to determine the upstream limits of the public right of navigation, and to report from time to time the result of such investigations to the end that a complete plan will be presented for the economical and comprehensive development of all the water resources, for all the aforesaid purposes, in each of the principal watersheds of the state; and each of said purposes is hereby declared to be a public use or is continued as a public use. It shall investigate and report as to the privileges heretofore granted affecting the use of the waters aforesaid and as to the terms of such privileges and whether the conditions thereof have been complied with or the terms expired or whether revocable and investigate and report as to the diversion rights in streams heretofore acquired by the state and as to the use being made of the waters affected thereby.

Each such plan for any watershed shall set forth the developments already made and authorized to be made in such watershed for one or more such purposes, whether by the state or otherwise, and the extent to which any such existing or authorized development may be improved, enlarged or extended so as to increase or extend its efficiency for any of the aforesaid purposes, to the end that all developments in each watershed for all such purposes may be co-ordinated and unified, the rights of the state asserted and utilized so as to combine the most economical construction, maintenance and operation, and the most efficient service, with the production of the largest net revenue and public benefit to the state which may be practicable.

§ 22. **Dams and other structures in streams; penalties.** No structure within the natural and ordinary high water mark of any stream, outside of the canal system, shall be made by any public authority or by any private person or corporation without notice to the conservation commission, and in no case without complying with such conditions as it may prescribe for preserving the channel and for safeguarding the public against danger from the waters impounded by such structures, and this prohibition shall apply to any renewal of existing structures. No such approval by the commission shall impair or affect any property rights, otherwise existing, which might be invaded by the construction

or maintenance of such dam. The commission shall have power, whenever in its judgment public safety shall so require, and after a hearing either on its own motion or upon complaint, to make and serve an order directing any person, corporation, officer or board, constructing, maintaining or using any dam in any of the waters of this state, outside the canal system, to remove or repair the same within such reasonable time and in such manner as shall be specified in such order and it shall be the duty of every such person, corporation and officer or board to obey, observe and comply with such order and with the conditions prescribed by the commission for preserving the channels of streams and for safeguarding the public against danger from waters impounded by structures hereinbefore referred to, and every person, corporation, officer or board, failing, omitting or neglecting so to do, or who hereafter constructs or reconstructs any dam in any of the waters aforesaid without submitting to said commission and obtaining its approval of plans for such structures or who hereafter fails to remove, construct or fails to reconstruct the same in accordance with the plans so approved shall forfeit to the people of this state not to exceed five hundred dollars for each and every offense; every violation of any such order or direction or requirement shall be a separate and distinct offense, and, in case of a continuing violation, every day's continuance thereof shall be and be deemed to be a separate and distinct offense. This section shall not apply if the dam is located on private property outside of any city or village and is not over ten feet in height at any point above the stream bed and is located where the average high water flow of the stream does not exceed three hundred cubic feet per second; but in any prosecution under this section the burden of establishing such facts shall rest upon the defense.

§ 23. **Actions to recover penalties.** An action to recover a penalty under the last section may be brought in any court of competent jurisdiction in this state on order of the conservation commission and in the name of the people of the state of New York. In any such action all penalties incurred up to the time of commencing the same may be sued for and recovered therein and the commencement of an action to recover such penalty shall not be, or be held to be, a waiver of the right to recover any other penalty. All moneys recovered in any such action, together with the costs recovered therein, shall be paid into the state treasury by the conservation commission to the credit of the general fund.

§ 24. **Powers of commission on investigations.** The commission shall have power to subpoena and require the attendance in this state of witnesses and the production by them of books and papers pertinent to the investigations and inquiries which it is authorized to make under any article of this chapter, and to examine them and such public records as it shall require in relation thereto, and for the purposes of such examinations the conservation commission shall possess all the powers conferred by the legislative law upon a committee of the legislature or by the code of civil procedure upon a board or committee, and may invoke the power of any court of record in the state to compel the attendance and testifying of witnesses and the production by them of books and papers as aforesaid.

§ 25. **Immunity of witnesses.** No person shall be excused from from testifying or from producing any books or papers in any investigation or inquiry by or upon any hearing before the commission or any commissioner, when ordered to do so by the commission, upon the ground that the testimony or evidence, books or documents required of him may tend to incriminate him or subject him to penalty or forfeiture, but no person shall be prosecuted, punished or subjected to any penalty or forfeiture for or on account of any act, transaction, matter or thing concerning which he shall under oath have testified or produced documentary evidence; provided, however, that no person so testifying shall be exempt from prosecution or punishment for any perjury committed by him in his testimony. Nothing herein contained is intended to give, or shall be constructed as in any manner giving, unto any corporation immunity of any kind.

## ARTICLE 6.

### HYDRAULIC DEVELOPMENT.

Section 400. General powers of commission as to hydraulic development; surplus of canal waters.

401. Codification of laws relating to hydraulic development.

§ 400. **General powers of commission as to hydraulic development; surplus of canal waters.** The commission shall have power to make plans, specifications and estimates and to enter into contracts for improvements thereunder and to acquire any necessary lands for the development of hydraulic power of streams with or without stream regulation, subject to such limitations and pursuant to such procedure as may be hereafter provided by law. On



certification by the superintendent of public works that at points to be specified by him surplus waters of the canals and canalized streams of the state, including diversion rights held by the state, are available for hydraulic uses, the commission may grant privileges to use the same to municipal or private users. Such grants shall be subject to the needs of navigation and to the jurisdiction of the superintendent of public works over the canals, and the gates through which such surplus waters are drawn shall be located on the canal lands of the state and shall be constructed by the department of public works according to plans prepared by the state engineer and surveyor and operated by the department of public works. No such privilege shall be granted for any term exceeding fifty years from the date of the grant, but any grant may be renewed or a new grant made in the manner herein provided not more than five years prior to the expiration of an outstanding grant, and to take effect on the expiration of the outstanding grant, and every such grant shall require payment annually by the grantee to the commission of a rental to be paid into the state treasury for general state purposes and to be not less than the value of the privileges as appraised by the commission, which appraisal shall be made not more than two years nor less than three months prior to the making of any grant, and the grant shall provide for a readjustment of such rental at the end of every ten year period computed from the date of the grant, at the instance of the commission or of the grantee, by agreement or by arbitration. No such grant shall be made until after notice given by the commission by publication in two newspapers printed in the county in which the surplus water is located and once a week for four successive weeks, stating the amount of the appraisal and the time and place where bids for the privilege will be received, and no bid shall be accepted which is for a sum less than the value of the privilege as appraised by the commission and except as aforesaid the privilege shall be granted to the highest bidder, but any bid may in the discretion of the commission be rejected for cause, to be stated by it. No transfer of any such privilege shall be made except with the approval of the commission. The commission shall have power to revoke such grants for nonuser or when combinations to restrain such use have been entered into by the grantee and to provide in such grants or otherwise for securing the payment of the rentals aforesaid and the commission may enforce such payment by suit or other proceedings in the name of the people of this state.

§ 401. **Codification of laws relating to hydraulic development.**  
The commission shall prepare and report, on or before January fifteenth, nineteen hundred and twelve, to the legislature a bill to revise and to consolidate into the conservation law all laws affecting hydraulic development and water storage for power purposes.

## ARTICLE 7.

### RIVER IMPROVEMENT.

- Section 450. General powers of commission as to river improvements.
- 451. Petition for river improvement.
  - 452. Determination upon petition for river improvement.
  - 453. Proceedings upon approval of petition for river improvement.
  - 454. Creation of improvement districts.
  - 455. Proceedings \*for final order approving petition for river improvement.
  - 456. Entry upon lands, structures and waters in proceeding for river improvement.
  - 457. Compensation of owners upon failure to agree in proceeding for river improvement.
  - 458. Warrant for payment of owners upon failure to agree in proceeding for river improvement.
  - 459. Bonds for river improvement.
  - 460. Proceedings for apportionment of cost of river improvements.
  - 461. Proceedings for assessment and collection of cost of river improvements.
  - 462. Operation, maintenance and expenses of river improvements and unlawful opening of gates of dam.
  - 463. Duties and qualifications of collectors and other officers.
  - 464. Ratification of proceedings for improvements.
  - 465. State jurisdiction of the improvement of water-courses at private expense.
  - 466. Refund of expenses in certain cases.
  - 467. Limitation of improvements.

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\* So in original.

**§ 450. General powers of commission as to river improvements.**

The commission shall have power, subject to the provisions of this chapter, to make plans, specifications and estimates and to enter into contracts for improvements thereunder and to acquire any necessary lands for the regulation by the state of the flow of streams as provided by this act or as shall be authorized by law. Whenever the commission, pursuant to the powers hereinbefore conferred upon it by this chapter, takes cognizance of its own motion of any matter to which this article relates, its procedure in the hearing and determination of the questions involved, the letting of contracts for and supervising of construction, entering upon lands, making compensation to owners, providing moneys therefor, proportioning cost and assessing benefits, shall conform to the provisions, so far as they can be made to apply, governing the like matters in proceedings begun by petition.

**§ 451. Petition for river improvement.** Any county, city, town or village located upon any river or watercourse, or any person or persons owning lands bordering thereon, may present to the commission a petition duly verified, setting forth the facts showing that the restricted or unrestricted flow thereof is a menace to the public health and safety and that it is necessary to the preservation of the public health and safety to regulate the same, and praying that the flow of water in such river or watercourse shall be regulated under the following provisions of this article, so far as necessary for that purpose. Such petition may be made on behalf of any county by the board of supervisors thereof, on behalf of any town by the supervisor thereof, on behalf of any city by the mayor or board of aldermen thereof, on behalf of any village by the president or board of trustees thereof.

**§ 452. Determination upon petition for river improvement.** The commission on receipt of any such petition shall forthwith determine whether the regulation of the flow of any such river or watercourse is of sufficient importance to the public health or safety to warrant the interference of the state under the provisions of this article, and shall certify its determination thereupon. If it shall determine that the relief prayed for should be granted, it shall at once make or cause to be made such preliminary surveys and investigations as may be proper to determine the causes of the excessive, restricted or irregular flow in such river or watercourse, the available means to correct the same for

the preservation of the public health and safety, and if relief therefrom is in the opinion of the commission practicable, to take such other and further action with reference to relieving the same as is hereinafter provided for.

§ 453. **Proceedings upon approval of petition for river improvement.** If such commission shall determine that a more beneficial flow of water in such river or watercourse can be had by construction of dykes, clearing out or changing the channel, the erection of a dam or dams or other public works thereon, or upon any tributary thereof, it shall cause to be made preliminary plans and specifications of such proposed improvements, together with a survey of the lands upon which such improvements are to be located, giving the location thereof, and of all lands to be taken, flowed or damaged thereby with a description by survey or otherwise, or all rights affected thereby and estimates of the total cost thereof. The commission shall also cause a map to be made showing all such lands, the number of acres in each separate tract and the names of the owners and occupant thereof so far as the said commission can ascertain the same. The commission or the members thereof may enter upon such lands as the commission shall deem necessary for the purpose of doing such work, either by themselves or by their engineers, agents or servants employed by them for that purpose. The commission shall also prepare a statement or list of the counties, towns, cities, villages and individual properties which in its judgment will be benefited thereby, together with a statement of the proportional share of said total cost which should be borne by the said counties, towns, cities and villages respectively, and by the individual owners of property benefited collectively, expressed in decimals; and in case any part or proportion of the cost of such improvement is not properly assessable upon the counties, towns, cities, villages or individual properties, or any of them, as not in the nature of a local improvement, such part or proportion of the expense shall be deducted from the total cost before apportioning the same upon the counties, towns, cities, villages, and individual properties as aforesaid, and shall be certified by the said commission to the legislature as a state charge. Such preliminary maps, plans, specifications, estimates and statements shall thereupon be filed in the office of the commission and in the county clerk's office of each county wherein is situated land to be taken or flowed

by such proposed improvements and of each county in which any of the aforesaid towns, cities, villages or individual properties benefited are situated. Upon the completion and filing of such preliminary maps, plans, specifications, estimates and statements, the commission shall give notice of the filing thereof, and of the time and place where said commission will give a hearing to persons interested therein, by advertising for two successive weeks in two newspapers published in each county where such improvement is proposed to be made and in the state paper published at Albany, at which time and place any person interested may appear and make any objection to or suggest any modification in said plans, maps and specifications, and said commission shall have power to adjourn said hearing from time to time as justice may require. Thereupon said commission shall determine whether such proposed improvement shall be abandoned or proceeded with and what, if any, modifications should be made in such plans, maps, specifications, estimates and statements and shall make such modifications. If said commission shall determine that said maps should be modified, so as to include territory to be taken or flowed, not included in the maps already filed, then they shall cause modified maps, specifications, estimates and statements to be prepared and filed as hereinbefore provided for said preliminary maps, plans, specifications, estimates and statements, and shall give notice of their completion and filing and of a hearing thereupon, in the manner hereinbefore prescribed for a hearing upon said preliminary maps, plans, specifications, estimates and statements. If said commission shall finally determine that the proposed improvements be made it shall thereupon make a final order directing the same to be made, and shall cause to be prepared final maps and detailed plans, specifications and estimates of the total cost thereof. The commission shall cause the said final order, maps, plans, specifications and estimates or duplicates thereof, certified by them, to be filed in the office of the county clerk of each county in which lands affected or benefited thereby are located. No such improvement shall be undertaken under this article pursuant to any such final order, or any other proceedings had thereupon except as hereinbefore provided, until after the said final order shall have been approved by a subsequent act of the legislature, which act shall authorize and direct such improvement to be made. If so approved, the said final order shall become effectual and not otherwise. The commission shall have power to make such minor changes in the

said final map, plans and order as the nature of the work may require, provided that such changes shall not add to exceed ten per centum to the cost of executing the plans embraced in such final order as approved by such act of the legislature; and provided, further, that if any such minor changes shall add more than ten per centum to the cost of any such improvement, a final order for which has been approved by an act of the legislature, the commission shall publish such fact and shall give a hearing thereon as in the first instance with special reference to such increased cost of improvement, and shall await thereafter a further and final approval by subsequent act of the legislature.

§ 454. **Creation of improvement districts.** At any time after such final order shall have been approved by the legislature, the commission shall determine what property included in the statement or list, as specified in section four hundred and fifty-three of this chapter, other than counties, towns, cities and villages, is to be benefited by such improvement, and it shall thereupon cause to be made a survey and map showing the lands so determined to be benefited and the name of the owner of each separate parcel so far as practicable, the quantity in each parcel and the boundary lines thereof, and where a parcel is intersected by a town or county line the quantity in such parcel on each side of the town or county line; and shall give to each parcel a corresponding number on said survey and map; and it shall also cause to be made a brief description or designation sufficient to identify the same, of all other property included in such statement or list so determined to be benefited, with the name of the owner thereof so far as practicable. When said survey and map and descriptions are completed a copy thereof with a certificate of their adoption duly signed by the commission shall be filed in the office of the clerk of each county in which any lands or property so determined to be benefited are situated or exist; and thereafter the commission shall fix a time and place in such county where the owners of said lands and property and other persons interested therein shall have an opportunity to be heard as to the lands and property to be benefited. Notice of the time and place of such hearing shall be given by the commission by notice published at least once a week for two successive weeks immediately prior to the time of such meeting in at least two newspapers published in such county. After such hearings, which may be adjourned from time to time by the commission or by any member thereof,

the commission may make any change in its determination as to the lands and property to be benefited; in case of any such change the commission shall make a supplementary survey and map and descriptions, in like manner as is hereinbefore provided with reference to the original survey and map and descriptions, showing such changes, and file in the clerk's office of each county where the lands and properties affected by such changes are situated or exist a copy of such supplemental survey and map and descriptions with a certificate of their adoption duly signed by the commission; and thereupon such original survey and map and descriptions, as modified by such supplemental survey and map and descriptions, if any, shall constitute the final determination of the commission as to the lands and property to be benefited by such improvement. Such final determination may be reviewed in like manner as a review is had of a determination of a board of assessors in making an assessment. Such determination as modified upon such review, if any, shall conclusively fix and establish the lands and properties benefited by said improvement, and the same together with the counties, towns, cities and villages included in said statement or list shall constitute an improvement district; and the proportional share of the total cost of such improvement and of the maintenance thereof so apportioned to the state and the counties, towns, cities and villages as provided in section four hundred and fifty-three of this chapter shall be a charge upon and be payable by the state and said counties, towns, cities and villages respectively, and the proportional share thereof collectively charged upon the lands and properties within such improvement district as in this article provided shall be a lien upon all the lands and properties within such improvement district and shall be borne by and assessed upon and collected from such lands and properties in the manner hereinafter provided.

In case any lands or properties heretofore or hereafter included with an improvement district so fixed and established by the commission shall not for any reason be properly or legally included therein or shall not for any reason be legally liable to assessment and taxation for the cost and expenses of an improvement for which such district has been or shall be so fixed and established, the said lands and properties shall nevertheless constitute and become a part of such improvement district and shall be legally liable to assessment and taxation for the cost and expenses of such improvement and the maintenance of the same

and the bonds and certificates issued therefor and the interest thereon in all respects as in this chapter provided, upon recording in the office of the clerk of the county or counties in which such lands or properties are located an instrument in writing duly executed, acknowledged and delivered to the commission by the owner or owners thereof consenting that the said lands and properties shall constitute a part of such improvement district; and thereupon all the provisions of this article shall apply to the improvement or regulation of a watercourse and its tributaries with respect to which such consents shall be so executed and recorded and as to which the lands and properties referred to in such consents shall constitute the improvement district in whole or in part. Jurisdiction is hereby conferred upon the supreme court and the county court of the county in which any of such lands or properties are located to authorize the execution and delivery to the commission of such consent upon such terms as the court shall approve on behalf of an infant or incompetent owner of such lands or properties in the same manner as provided by law with respect to the sale, mortgage or lease of the real property of an infant or incompetent person.

**§ 455. Proceedings after final order approving petition for river improvement.** When any such final order shall have been made and approved as hereinbefore provided, the commission shall advertise two successive weeks in the state paper and in two newspapers published in the county wherein such work is to be performed, and if in more than one county then in each of such counties, and in such other newspaper as shall be deemed of advantage, for bids or proposals for said work to be made in writing for the construction of such dam or dams, dykes or other works according to such plans and specifications. Upon the receipt of the proposals, the commission may enter into a contract or contracts with the lowest responsible bidders for the work to be done, or may reject any or all bids and again advertise for further bids. Before entering into any such contract, a bond with sufficient sureties shall be required, conditioned that the contractor will perform all work within the time prescribed in accordance with the plans and specifications, and will indemnify the state and said commission of and from all liability for damages occasioned or suffered by reason of the negligence or willful fault of such contractor, his employees or any subcontractor or his employees in doing such work. Partial payments for work



actually done may be provided for in the contracts and paid in the manner hereinafter provided to an amount not to exceed ninety per centum of the contract price. The payments due on account of any such contracts or for any necessary expense or work in connection therewith in pursuance of this article shall be paid from the river improvement fund as hereinafter provided for.

§ 456. **Entry upon lands, structures and waters in proceeding for river improvement.** The commission may enter upon any land, structures and waters necessary for the purposes of this article so far as the same relate to proceedings for the improvement of rivers and watercourses, and may determine that the right to temporary or perpetual use and occupancy of the property to be taken for the purpose of such improvement is a sufficient title and interest to be acquired therein. If the owner of any property to be taken for such improvement shall agree with the commission upon the sum to be paid therefor, or for the right to use and occupy the same or for any legal damages sustained, such sum shall be paid as hereafter provided as part of the necessary expense incurred for the purposes of such improvement.

§ 457. **Compensation of owners upon failure to agree in proceeding for river improvement.** If the commission cannot agree with the owners upon the compensation and legal damages to be paid for the property to be so taken and appropriated, the commission shall thereupon serve upon such persons a notice that the lands and property described therein have been appropriated by the state for the purposes of this article, and shall proceed to acquire title thereto under the provisions of title one of chapter twenty-three of the code of civil procedure, known as the condemnation law, but service of such notice shall raise no presumption that the lands described therein are private property.

§ 458. **Warrant for payment of owners upon failure to agree in proceeding for river improvement.** When proceedings are taken under the condemnation law as provided in the preceding section the commission shall cause to be filed in the comptroller's office a certified copy of the final order provided in section thirty-three hundred and seventy-one of the code of civil procedure, and a certified copy of the judgment therein rendered pursuant to section thirty-three hundred and seventy-three of said code, together with a certificate of the deputy attorney-general assigned

to the department that no appeal from such final order and judgment has been or will be taken by the state, or if an appeal has been taken, a certified copy of the final judgment of the appellate court affirming in whole or in part said final judgment. The comptroller shall issue to the said commission, or such officer as it shall direct, his warrant for the payment of the amount due upon such final order and judgment with interest from the date of the judgment until the thirtieth day after the entry of such final order and judgment, and the same shall be paid out of the river improvement fund hereinafter provided for. Such warrant shall be payable to and shall be delivered by the commission or its officers to the owner or owners of said judgment according to the terms thereof.

§ 459. **Bonds for river improvement.** To pay the cost of such improvement and all the expenses and liabilities lawfully incurred by the commission under this article in connection therewith and in the maintenance thereof and the certificates authorized by this article to be issued and the interest thereon the commission is hereby authorized to issue, in the name of and under the seal of said commission and subscribed by the chairman, in behalf of such improvement district, bonds in a sum not exceeding the amount of the estimated total cost of said improvement and ten per centum thereof in addition thereto, but without liability on the part of the commission or any commissioner personally for the payment thereof or of the interest thereon and without liability on the part of the state beyond the proportion of any assessment to be made or certified against the state on account of said improvement. Such bonds, together with interest thereon at a rate not exceeding five per centum, payable semi-annually, shall be payable by their terms by the state, municipality and by assessment and levy of taxes upon the lands and properties in such improvement district according to the proportional share thereof determined as herein provided, and they shall be executed when authorized by the commission and attested by the secretary of the department. Such bonds shall be issued in serial form in amounts to be fixed by the commission; they shall by their terms become due and payable as determined by the commission in not exceeding fifty years from the date of issue, and they shall be exempt from all taxation by the state or by any county, town, city, village or other subdivision of the state. Such bonds shall be sold by the comptroller at not less than par and accrued interest, and

the proceeds thereof deposited in a national or state bank either at Albany or in one of the counties in which such improvement is made, to be approved by the comptroller and the commission. But before any such deposit is made, the comptroller shall require from the depository a bond as security for the repayment of same, to be approved by him as to form, condition and sufficiency of sureties, which shall provide for the repayment to the commission upon demand of the moneys so deposited. Moneys received under the provisions of this article for river improvements shall constitute a fund to be known as the river improvement fund, and the portion thereof applicable to each improvement shall be separately kept by the comptroller, and the same are hereby pledged to the payment of the cost and expenses of such improvement and the maintenance thereof, and the bonds to be issued as in this article provided, so far as the same are applicable to such improvement, and the comptroller is authorized and directed to pay therefrom the principal and interest of said bonds as the same mature and become payable by the terms thereof, and the costs and expenses of such improvement and the maintenance thereof upon the order of the commission or its authorized officer. In case the proceeds of the sale of bonds exceed the total amount of the cost and expenses of such improvement, such excess shall be applied by the comptroller to the payment of the principal and interest of such bonds and the maintenance of such improvement.

**§ 460. Proceedings for apportionment of cost of river improvements.** The commission shall assess upon the lands and properties in such improvement district benefited collectively as determined under the provisions of this article, the benefit accruing thereto by reason of such improvement in the following manner. The commission shall determine, after an investigation thereof, the amount of such benefit received by said lands and properties and shall specify the same in a statement thereof opposite the number of each parcel of land and each designation or description of property corresponding with the number thereof on said survey and map and descriptions of such improvement district with the name of the owner or owners thereof, as the same appear on said map and survey and descriptions; such statement shall be signed by the chairman of the commission and a copy of so much thereof, duly certified by the secretary of the department, shall be filed in the clerk's office of each county as relates to the lands and property included in each county. A copy of such statement shall be served

upon the owner or owners of such lands and properties assessed, together with a notice specifying the time and place in the county where the commission shall sit to hear any person interested in or aggrieved by such determination; such service shall be made by delivering the same to each of said owners or to any one of several owners or to the tenant of any such lands or properties or by posting the same upon any such lands or properties; such service shall be made at least fifteen days before such hearing, and said statement and notice shall also be published in at least two newspapers published in the county wherein said hearing is to be held at least two weeks immediately prior thereto. The affidavit of said service and publication shall be evidence thereof. The commission shall sit at the time and place specified in such notice, or at the times and places to which said hearing may be adjourned by the commission, and hear all persons interested in or aggrieved by such determination; after such hearing or hearings the commission may change or modify such determination, in which case it shall specify such change or modification in a statement thereof to be signed and filed in like manner as hereinbefore provided with reference to such original determination. Any person aggrieved by such determination as originally made or as so modified may review the same in like manner as a review is had of the determination of a board of assessors in making an assessment. And such determination, as so modified and as further modified by any final judgment or order made in proceedings to review the same as herein provided, shall be final and conclusive, and the amount of the total cost and expense of such improvement and the maintenance thereof and the bonds and certificates to be issued as in this article provided and the interest thereon, which said several parcels of land and properties are to pay and bear shall be based upon the amount of the benefit accruing to them respectively as specified in and in accordance with said determination as so modified as hereinafter provided, provided, however, that if any of the properties included in such improvement district and in such determination shall cease to exist, so that no part of the tax to be levied thereon as herein provided can be collected against the same, and due proof thereof shall be made to the commission, the commission may apply to the supreme court for an order to show cause why such property should not be thereafter omitted from the assessment-roll of the town or city wherein the same is situated, as herein provided; such order to show cause shall be served upon the owner or owners of all the properties in such improvement district, so

far as the same can be ascertained, in such manner as the court shall direct, and in case the court shall upon the return of said order so direct the said property shall be thereafter omitted from the assessment-roll of said town or city, with the same force and effect in all respects as if the same had not been included in such improvement district, or in said determination. The commission shall annually transmit to the board of supervisors of each county in such improvement district a statement of the amount required to be paid by the lands and properties in said county included in such improvement district, as specified in the determination of the commission, of bonds issued for such improvement maturing during the then ensuing year together with interest thereon, and of the certificates issued by the commission as herein provided remaining unpaid and interest thereon and of the cost of the maintenance of such improvement for such year, which statement shall be approved by the comptroller, and thereupon said board of supervisors shall cause the same to be levied and collected as hereinafter provided.

§ 461. **Proceedings for assessment and collection of cost of river improvements.** For the purpose of raising money to meet the said bonds and the interest thereon, and to provide for the costs and expenses of such improvement and the maintenance thereof the commission shall annually transmit to the comptroller a statement of the amount of the proportion thereof to be paid by the state during such year, in conformity with the determination of the commission in respect thereto as provided in this article, and such amount shall be by the comptroller paid into the river improvement fund herein mentioned applicable to such improvement out of the moneys of the state appropriated for that purpose; and the commission shall annually transmit to the clerk of the board of supervisors of each county, the clerk of each town, the mayor of each city, and the president of each village affected by such improvement a statement of the amount of the proportional share thereof to be paid by such county, town, city or village respectively, as determined by the commission, and such county, town, city or village shall cause the same to be assessed, levied and collected in the same manner as provided by law with reference to general taxes, and paid to the treasurer of the county, who shall forthwith forward the same, less his legal fees therefor, to the comptroller to be by him paid into the river improvement

fund applicable to such improvement; and the commission shall annually transmit to the clerk of the board of supervisors of each county included in such improvement district a statement of the amount of the proportional share thereof to be borne by the lands and properties collectively in such improvement district within such county during such year, to be assessed, levied and collected as hereinafter provided. The assessors of each town and city included in such improvement district are hereby required to enter upon a separate page in the annual assessment-roll of such town or city before the delivery thereof to the board of supervisors the description by number corresponding with the number thereof on said survey, map and descriptions so filed in the county clerk's office, each parcel of land and each designation or description of property within the county in such improvement district, together with the name of the then owner or owners thereof so far as the same can be ascertained by the assessors, and set opposite such number and description of each separate parcel or property in the column of said roll for the total assessed valuation of property the amount of benefit by reason of such improvement received by such parcel or property as stated and specified in the determination of the commission as modified by the court if so modified, on file in the office of the clerk of the county. And the board of supervisors shall each year at the time the annual tax levy is made, levy upon each separate parcel and property in said county within such improvement district appearing upon the assessment-rolls of the towns and cities included therein as herein provided such portion of the amount to be paid by all of the property in said county within such improvement district appearing by the statement of the commission and the comptroller made to said board as in this article provided as the amount so assessed against such parcel or property on said rolls for benefit accruing thereto bears to the aggregate amount so assessed on said rolls against all of said lands and properties, and the said taxes so levied shall be collected in the same manner as general taxes are levied and collected, and shall be a like lien as general taxes until the amount thereof is paid to the general treasurer of the county, superior in force and effect to all other liens except unpaid general taxes; provided, however, that the collection of such tax shall only be enforced by a sale of the land or property assessed. Such taxes when collected shall be paid to the treasurer of said county who shall forthwith pay the same less his legal fees to the comptroller who shall pay the same into the river improvement fund.

**§ 462. Operation, maintenance and expenses of river improvements and unlawful opening of gates of dam.** The care, control, operation and maintenance of improvements to rivers and water-courses provided for in this article shall devolve upon the commission. The commission shall have power to charge to each such improvement undertaken such portion of the expenses incurred as he shall determine ratably and equitably, chargeable thereto and to include the same in the apportionment or assessment of the cost and expenses of such improvement. Any person who shall open or close or cause to be opened or closed a gate or gates in any dam constructed under this article so far as the same relates to such improvements or a gate in any head race without the consent of the commission, shall be guilty of a misdemeanor.

**§ 463. Duties and qualifications of collectors and other officers.** It shall be the duty of each collector and other official to whom is delegated the performance of any service under the provisions of this article to faithfully perform the same, and the collector of each town and the treasurer or collecting officer of each city whose duty it shall be to collect assessments as herein provided shall before entering upon the discharge of his duties execute to the people of the state an undertaking with two or more sureties in the penal sum of twice the amount to be collected by him, and such undertaking shall be approved and filed in the same manner and with the same force and effect as provided by law with reference to an undertaking for the collection of general taxes, and shall provide that he will well and faithfully perform his duty as collector and will pay over to the treasurer of his county and fully account for all moneys received by him under the provisions of this article within the same time as provided by law with reference to general taxes. And such collecting officer shall be entitled to receive the same compensation as fixed by law for the collection of general taxes. And each county treasurer whose duty it shall be to receive any assessments or moneys as herein provided shall, before entering upon the discharge of his duties, execute to the people of the state an undertaking in such amount and with such sureties as shall be required by the comptroller, conditioned that he will forthwith pay over to the comptroller upon the receipt thereof by him and account for all moneys which shall come into his hands under the

provisions of this article and will well and faithfully perform all the duties required of him thereunder.

§ 464. **Ratification of proceedings for improvements.** All proceedings heretofore taken under the provisions of chapter seven hundred and thirty-four of the laws of nineteen hundred and four, and the acts amendatory thereof and supplemental thereto are hereby legalized, ratified and confirmed; but this provision shall not be deemed to dispense with the submission to and approval by the legislature of specific orders, heretofore made by the state water supply commission, for river improvements, pursuant to any requirement of article two of the state boards and commissions law, nor shall the repeal, by this chapter, of any section of such law be deemed to affect such requirement.

§ 465. **State jurisdiction of the improvement of watercourses at private expense.** The board of trustees of any village may present to the commission a petition requesting it to assume jurisdiction of the construction of a proposed improvement to a watercourse adjacent to or in the vicinity of such village. Such petition shall state the location of such watercourses, the character of the proposed improvement, the estimated cost thereof, shall set forth the fact that unless such improvement is made such watercourse is a menace to the public health and safety of the inhabitants of such village, and shall request that the commission assume jurisdiction of the construction of such improvement, as provided by this section. The petition must also state that if the commission assumes jurisdiction of such improvement the money needed therefor will be deposited to the order of the commission in a national bank to be designated by it. The petition shall be accompanied by a plan for such improvement, together with an estimate of the cost thereof, prepared by a competent engineer. Upon the receipt of such petition, the commission shall forthwith cause an investigation to be made and shall determine whether the proposed improvement is of sufficient importance to the public health or safety to warrant the commission in assuming jurisdiction. If it shall determine in the affirmative, the commission shall cause to be made an estimate of the cost thereof, and upon the deposit of money in an amount equal to such estimated cost, the commission shall cause such improvement to be made substantially in accordance with the plan proposed by the



petition. If such improvement involves the acquisition of land or water rights the commission may acquire the same by condemnation, if unable to agree upon a purchase price, and shall pay the expenses of proceedings and the awards therein out of the money deposited to its credit. If the improvement consists of the construction or improvement of a dam, the petition may state the levels at which it is proposed to maintain the water stored by such dam, and if the commission accepts jurisdiction of the construction of such improvement in accordance with this section, it shall cause the water stored by such dam to be maintained at the level specified in such petition.

§ 466. **Refund of expenses in certain cases.** If subsequent to the construction of such improvement at private expense as provided by the preceding section, the state shall improve such watercourse, pursuant to the provisions of this article, and if the dam or other structure so constructed or improved at private expense would naturally constitute a part of the plan for the improvement of such watercourse by the state, and shall take possession of such improvement and of the dam and other structures and property appurtenant thereto, the persons by whom the money to make such improvement was contributed may present a claim therefor to the court of claims. Jurisdiction is hereby conferred upon the court of claims to hear such claims, and if the court shall determine that the improvement was paid for by the claimants and would have naturally constituted a part of the improvement of such watercourse by the state if such improvement had not already been made at private expense and that claimant has suffered legal damages by the act of the state, the court shall award to such claimants the amount of money contributed by them toward such expense not exceeding the actual value of the improvements, and the amounts of such awards shall be payable from the money appropriated for the greater improvement of which such improvement would naturally constitute a part.

§ 467. **Limitation of improvements.** No final order shall be made in any proceeding conducted exclusively under the provisions of this article when such proceeding and the plans and improvements thereunder shall involve the construction of any dam or dams, the storage of water by which shall result in substantially increasing the hydraulic power upon lands located below such dam or dams.

# ARTICLE 8.

## DRAINAGE.

- Section 480. Powers and duties of the commission as to the drainage of land.
481. Petition for drainage improvements.
482. Determination upon petition for drainage improvements.
483. Proceedings upon approval of petition for drainage improvements.
484. Creation of drainage improvement districts.
485. Proceedings after final order approving petition for drainage improvements.
486. Entry upon lands, structures and waters in proceedings for drainage improvements.
487. Compensation of owners upon failure to agree in proceeding for drainage improvements.
488. Warrant for payment of owners upon failure to agree in proceeding for drainage improvements.
489. Bonds for drainage improvements.
490. Application of certain provisions of this chapter, relating to assessments and their collection.
491. Operation, maintenance and expenses of drainage improvements.

§ 480. Powers and duties of the commission as to the drainage of land. In addition to the other powers and duties of the commission conferred or imposed on said commission by this chapter, it shall possess the powers and exercise the duties hereinafter prescribed in respect to the drainage of lands. Whenever, of its own motion or upon the application of any person or corporation, municipal or otherwise, the commission shall determine after a hearing and investigation that any swamp, bog, pond, meadow or other low or wet lands within the state should be drained, or the condition thereof as affected by water improved, for the purpose of the conservation of either the public health or the public safety or the public welfare, or all or any of them, by means of the construction and operation of a ditch or ditches, pipe or other channel or channels or dams, dykes, gates and sluices or the improvement of an existing channel or channels or by other construction, it shall have jurisdiction in the

premises. Whenever the commission of its own motion takes cognizance of any of said matters, its procedure in the hearing and determination of the question involved, the letting of contracts for and supervising the construction, entering upon lands, making compensation to owners providing moneys therefor, apportioning cost and assessing benefits shall conform to the provisions, so far as they can be made to apply, governing the like matters in proceedings begun by petition.

§ 481. **Petition for drainage improvements.** Any county, city, town or village in which is located, or any person or persons possessing, a swamp, bog, pond, meadow or other low or wet lands, or any person or persons in the vicinity thereof, may present to the commission a petition duly verified, setting forth the facts showing that the swamp, bog, pond, meadow or other low or wet lands, is a menace to the public health or safety or welfare and that it is necessary to the conservation of the public health or safety, or the conservation of the public welfare, to drain or improve the same, and praying that the same be drained and improved and that a ditch or ditches, pipe or other channel or channels, or dams, dykes, gates and sluices be constructed and operated, or that an existing channel or channels be improved, or that other works be constructed, through or upon the same or through or upon the lands of others, under the provisions of this article, so far as necessary for any or all of such purposes. Such petition may be made on behalf of any county by the board of supervisors thereof, on behalf of any town by the supervisor thereof, on behalf of any city by the mayor or board of aldermen thereof, on behalf of any village by the president or board of trustees thereof.

§ 482. **Determination upon petition for drainage improvements.** Such commission on receipt of any such petition shall forthwith determine whether the draining and improving of said lands and the construction and operation of a ditch or ditches, pipe or other channel or channels, dams, dykes, gates and sluices, or the improvement of an existing channel or channels, or the construction of other works, is of sufficient importance to the public health or safety, or sufficiently conducive to public welfare, to warrant the interference of the state under the provisions of this article, and shall certify its determination thereupon. If

it shall determine that the relief prayed for should be granted, such commission shall at once make or cause to be made such preliminary surveys and investigations as may be proper to determine the available means to correct the said conditions for the conservation of the public health and safety, or for the conservation of public welfare, and if relief therefrom is in the opinion of the commission practicable, to take such other and further action with reference to relieving the same as is hereinafter provided for.

§ 483. **Proceedings upon approval of petition for drainage improvements.** If such commission shall determine and certify that the relief prayed for should be granted, it shall cause to be made preliminary plans and specifications of such proposed improvements, together with a survey of the lands upon which such improvements are to be located, giving the location thereof, and of all lands to be taken, or on or over which an easement is to be taken, and of all lands to be damaged thereby, with a description, by survey or otherwise, of all property and rights affected thereby, and estimate of the total cost thereof. The commission shall also cause a map to be made showing all such lands, the number of acres in each separate tract and the names of the owners and occupants thereof so far as the said commission can ascertain the same. The commission or the members thereof may enter upon such lands as the commission shall deem necessary for the purpose of doing such work, either by themselves or by their engineers, agents or servants employed by them for that purpose. The commission shall also prepare a statement or list of the counties, towns, cities, villages and individual properties which in its judgment will be benefited thereby, together with a statement of the proportional share of said total cost which should be borne by the said counties, towns, cities and villages, respectively, and by the individual owners of property benefited collectively, expressed in decimals; and in case any part or proportion of the cost of such improvement is not properly assessable upon the counties, towns, cities, villages or individual properties, or any of them, as not in the nature of a local improvement, such part or proportion of the expense shall be deducted from the total cost before apportioning the same upon the counties, towns, cities, villages and individual properties as aforesaid, and shall be certified by the said commission to the legislature as a state

charge. Said preliminary maps, plans, specifications, estimates and statements shall thereupon be filed in the office of the commission and of the county clerk of each county wherein is situated land or easements to be taken for such proposed improvements and of each county in which any of the aforesaid towns, cities, villages or individual properties benefited are situated. Upon the completion and filing of such preliminary maps, plans, specifications, estimates and statements, the commission shall give notice of the filing thereof, and of the time and place where said commission will give a hearing to persons interested therein, by advertising for two successive weeks in two newspapers published in each county where such improvement is proposed to be made, and in the state paper published at Albany, at which time and place any person interested may appear and make any objection to or suggest any modifications in said plans, maps and specifications, and said commission shall have power to adjourn said hearing from time to time as justice may require. Thereupon said commission shall determine whether such proposed improvement shall be abandoned or proceeded with, and what, if any, modifications should be made in such plans, maps, specifications, estimates and statements and shall make such modifications. If said commission shall determine that said maps should be modified so as to include the maps and statements already filed, then they shall cause modified maps, specifications, estimates and statements to be prepared and filed as hereinbefore provided, for said preliminary maps, plans, specifications, estimates and statements, and shall give notice of their completion and filing and of a hearing thereupon, in the manner hereinbefore prescribed for a hearing upon said preliminary maps, plans, specifications, estimates and statements. If said commission shall finally determine that the proposed improvement be made, it shall thereupon make a final order directing the same to be made, and shall cause to be prepared a final map and detailed plans, specifications and estimates of the total cost thereof. The commission shall cause the said final order, maps, plans, specifications and estimates, or duplicates thereof, certified by them, to be filed in the office of the county clerk of each county in which lands affected or benefited thereby are located. No such improvement shall be undertaken under this article pursuant to any such final order, or any other proceedings had thereon except as hereinbefore provided, until after said final order shall have been approved by

the governor. If so approved, the said final order shall become effectual and not otherwise. The commission shall have power to make such minor changes in the said final map, plans and order as the nature of the work may require, provided that such changes shall not add to exceed ten per centum to the cost of executing the plans embraced in such final order as approved by such act of the legislature; and provided, further, that if any such minor changes shall add more than ten per centum to the cost of any such improvement, a final order for which has been approved by the governor, the commission shall publish such fact and shall give a hearing thereon as in the first instance with special reference to such increased cost of improvement, and shall await thereafter a further and final approval by the governor.

§ 484. **Creation of drainage improvement districts.** At any time after such final order shall have been approved by the governor the commission shall determine what property included in the statement or list as specified in section four hundred and eighty-three of this chapter, other than counties, towns, cities and villages, is to be benefited by such improvement, and it shall thereupon cause to be made a survey and map showing the lands so determined to be benefited and the name of the owner of each separate parcel so far as practicable, the quantity in each parcel and the boundary lines thereof and where a parcel is intersected by a town or county line the quantity in such parcel on each side of the town or county line; and shall give to each parcel a corresponding number on said survey and map; and it shall also cause to be made a brief description or designation sufficient to identify the same, of all other property included in such statement or list so determined to be benefited, with the name of the owner thereof so far as practicable. When said survey and map and descriptions are completed a copy thereof with a certificate of their adoption duly signed by the commission shall be filed in the office of the clerk of each county in which any lands or property so determined to be benefited are situated or exist; and thereafter the commission shall fix a time and place in such county where the owners of said lands and property and other persons interested therein shall have an opportunity to be heard as to the lands and property to be benefited. Notice of the time and place of such hearing shall be given by the commission by notice published at least once a week for two successive weeks immediately prior to

the time of such meeting in at least two newspapers published in such county. After such hearings, which may be adjourned from time to time by the commission or by any member thereof, the commission may make any change in its determination as to the lands and property to be benefited; in case of any such change the commission shall make a supplementary survey and map and descriptions, in like manner as is hereinbefore provided with reference to the original survey and map and descriptions, showing such changes, and file in the clerk's office of each county where the lands and property affected by such changes are situated or exist a copy of such supplemental survey and map and descriptions with a certificate of their adoption duly signed by the commission; and thereupon such original survey and map and descriptions, as modified by such supplemental survey and map and descriptions, if any, shall constitute the final determination of the commission as to the lands and property to be benefited by such improvement. Such final determination may be reviewed in like manner as a review is had of a determination of a board of assessors in making an assessment. Such determination as modified upon such review, if any, shall conclusively fix and establish the lands and properties benefited by said improvement, and the same together with the counties, towns, cities and villages included in said statement or list shall constitute an improvement district; and the proportional share of the total cost of such improvement and of the maintenance thereof so apportioned to the state and the counties, towns, cities and villages as provided in section four hundred and eighty-three of this chapter shall be a charge upon and be payable by the state and said counties, towns, cities and villages respectively, and the proportional share thereof collectively charged upon the lands and properties within such improvement district as in this act provided shall be a lien upon all the lands and properties within such improvement district and shall be borne by and assessed and levied upon and collected from such lands and properties in the manner hereinafter provided.

In case any lands or properties heretofore or hereafter included within an improvement district so fixed and established by the commission shall not for any reason be properly or legally included therein or shall not for any reason be legally liable to assessment and taxation for the cost and expenses of an improvement for which such district has been or shall be so fixed and established, the said lands and properties shall nevertheless constitute and be-

come a part of such improvement district and shall be legally liable to assessment and taxation for the cost and expenses of such improvement and the maintenance of the same and the bonds and certificates issued therefor and the interest thereon in all respects as in this chapter provided, upon recording in the office of the clerk of the county or counties in which such lands or properties are located an instrument in writing duly executed, acknowledged and delivered to the commission by the owner or owners thereof consenting that the said lands and properties shall constitute a part of such improvement district; and thereupon all the provisions of this article shall apply to the drainage or improvement of said lands with respect to which such consents shall be so executed and recorded and as to which the lands and properties referred to in such consents shall constitute the improvement district in whole or in part. Jurisdiction is hereby conferred upon the supreme court and the county court of the county in which any of such lands or properties are located to authorize the execution and delivery to the commission of such consent upon such terms as the court shall approve on behalf of an infant or incompetent owner of such lands or properties in the same manner as provided by law with respect to the sale, mortgage or lease of the real property of an infant or incompetent person.

§ 485. **Proceedings after final order approving petition for drainage improvements.** When any such final order shall have been made and approved by the governor, such commission shall advertise two successive weeks in the state paper and in two newspapers published in the county wherein such work is to be performed, and if in more than one county then in each of such counties, and in such other newspaper as shall be deemed of advantage, for bids or proposals for said work to be made in writing for the construction of the necessary drains, ditches, pipes, channels, dams, dikes, gates, sluices or other improvements according to such plans and specifications. Upon the receipt of the proposals, such commission may enter into a contract or contracts with the lowest responsible bidders for the work to be done, or may reject any or all bids and again advertise for further bids. Before entering into any such contract, a bond with sufficient sureties shall be required, conditioned that the contractor will perform all work within the time prescribed in accordance with the plans and specifications, and will indemnify the state and said commission of and from all



liability for damages occasioned or suffered by reason of the negligence or willful fault of such contractor, his employees or any subcontractor or his employees in doing such work. Partial payments for work actually done may be provided for in the contracts and paid in the manner hereinafter provided to an amount not to exceed ninety per centum of the contract price. The payments due on account of any such contracts or for any necessary expense or work in connection therewith shall be paid from the drainage fund as hereinafter provided for.

§ 486. **Entry upon lands, structures and waters in proceeding for drainage improvements.** The commission may enter upon any land, structures and waters necessary for the purposes of this article and may determine that the right to temporary or perpetual use and occupancy of the property to be taken for the purpose of such improvement is a sufficient title and interest to be acquired therein. If the owner of any property to be taken, or on or over which an easement is to be taken, for such improvement shall agree with said commission upon the sum to be paid therefor, or for the right to use and occupy the same, or for any damages sustained, such sum shall be paid as hereinafter provided as part of the necessary expense incurred for the purpose of such improvement.

§ 487. **Compensation of owners upon failure to agree in proceeding for drainage improvement.** If the commission cannot agree with the owners upon the compensation and damages to be paid for the property or easement to be so taken and appropriated the commission shall thereupon serve upon such persons a notice that the lands, easement or other property described therein have been appropriated by the state for the purposes of this article and shall proceed to acquire title thereto under the provisions of title one of chapter twenty-three of the code of civil procedure, known as the condemnation law.

§ 488. **Warrant for payment of owners upon failure to agree in proceeding for drainage improvement.** When proceedings are taken under the condemnation law as provided in the preceding section the commission shall file in the comptroller's office a certified copy of the final order provided for in section thirty-three hundred and seventy-one of the code of civil procedure, and a cer-

tified copy of the judgement therein rendered pursuant to section thirty-three hundred and seventy-three of said code, together with a certificate of the deputy attorney-general assigned to the department that no appeal from such final order and judgment has been or will be taken by the state, or if an appeal has been taken, a certified copy of the final judgment of the appellate court affirming in whole or in part said final judgment. The comptroller shall issue to the said commission, or such officer thereof as it shall direct, his warrant for the payment of the amount due upon such final order and judgment with interest from the date of the judgment until the thirtieth day after the entry of such final order and judgment, and the same shall be paid out of the drainage fund hereinafter provided for. Such warrant shall be payable to and shall be delivered by the commission or its officers to the owner or owners of said judgment according to the terms thereof.

§ 489. **Bonds and drainage improvements.** To pay the cost of any such improvement and all the expenses and liabilities lawfully incurred by the commission under this article in connection therewith and the maintenance thereof and the interest thereon the commission is hereby authorized to issue, in the name of and under the seal of said commission, in behalf of such improvement district, bonds in a sum not exceeding the amount of the estimated total cost of said improvement and ten per centum thereof in addition thereto, unless the governor shall under the provisions of section four hundred and eighty-three of this chapter authorize the expenditure of an additional amount in excess of ten per centum of the amount of said estimated cost by a further final order as therein provided, in which case such bonds may be issued for such additional amount, but the issuance of such bonds shall be without liability on the part of the commission or any commissioner personally for the payment thereof or of the interest thereon and without liability on the part of the state beyond the proportion of any assessment to be made or certified against the state on account of said improvement. Such bonds, together with interest thereon at a rate not exceeding five per centum, payable semi-annually, shall be payable by their terms by the state, municipality and by assessment and levy of taxes upon the lands and properties in such improvement district according to the proportional share thereof determined as herein provided, and they shall be executed when authorized by the commission by the president of the commission and attested by the secretary thereof. Such bonds shall be issued

in serial form in amounts to be fixed by the commission; they shall by their terms become due and payable as determined by the commission in not exceeding fifty years from the date of issue, and they shall be exempt from all taxation by the state or by any county, town, city, village or other subdivision of the state, and shall be a legal investment for savings banks, trust companies, executors and trustees. Such bonds shall be sold by the comptroller at not less than par and accrued interest, and the proceeds thereof deposited in a national or state bank or trust company either at Albany or in one of the counties in which such improvement is made, to be approved by the comptroller and the president of the commission. But before any such deposit is made, the comptroller shall require from the depository a bond as security for the repayment of the same, to be approved by him as to form, condition and sufficiency of securities, which shall provide for the repayment to the commission upon demand of the moneys so deposited. Moneys received under the provisions of this article shall constitute a fund to be known as the drainage fund, and the portion thereof applicable to each improvement shall be separately kept by the comptroller, and the same are hereby pledged to the payment of the cost and expenses of such improvement and the maintenance thereof, and the bonds to be issued as in this article provided, so far as the same are applicable to such improvement, and the comptroller is authorized and directed to pay therefrom the principal and interest of said bonds as the same mature and become payable by the terms thereof, and the costs and expenses of such improvement and the maintenance thereof upon the order of the commission or the authorized officer thereof. In case the proceeds of the sale of bonds exceed the total amount of the cost and expenses of such improvement, such excess shall be applied by the comptroller to the payment of the principal and interest of such bonds and the maintenance of such improvement.

§ 490. **Application of certain provisions of this chapter, relating to assessments and their collection.** The provisions of sections four hundred and sixty and four hundred and sixty-one and all of the powers, duties and proceedings therein provided for, shall apply to improvements made under this article, with the same force and effect as if such improvements were river improvements, except that the references in section four hundred and sixty-one to the

river improvement fund shall, in proceedings which relate to improvements under this article, be deemed to refer to the drainage fund, and the provisions of section four hundred and sixty-three, and the powers, duties and proceedings therein provided for, shall also apply to assessments under this article.

§ 491. **Operation, maintenance and expenses of drainage improvements.** The care, control, operation and maintenance of improvements provided for in this article shall devolve upon the commission. The commission shall have power to charge to each such improvement undertaken by it such portion of the expenses so incurred as it shall determine ratably and equitably is chargeable thereto and to include the same in the apportionment or assessment of the cost and expenses of such improvement. Any person who shall open or close or cause to be opened or closed a gate or gates, or otherwise interfere with any dam, dike, ditch, pipe, sluice or channel constructed or improved under this article, without the consent of the commission or an officer thereof, shall be guilty of a misdemeanor.

## ARTICLE 9.

### WATER SUPPLY.

Section 520. General powers of commission in relation to water supply.

521. Municipal corporations must submit maps and profiles of new or additional sources of water supply.

522. Petition for approval of plans for water supply and proceedings thereupon.

523. Approval of work.

524. Water supply to be used in other states.

525. Sewage disposal as affecting potable waters.

§ 520. **General powers of commission in relation to water supply.** The commission shall have the powers and perform the duties in relation to the supply of potable waters for the various municipalities, civil divisions and inhabitants of the state, set forth in this article, and as may be further provided by law.

§ 521. **Municipal corporations must submit maps and profiles of new or additional sources of water supply.** No municipal corporation or other civil division of the state, and no board, com-

mission or other body of or for any such municipal corporation or other civil division of the state shall, nor shall any person or waterworks corporation engaged in supplying or proposing to supply the inhabitants of any municipal corporation or other civil division of the state with water, after this chapter takes effect, have any power to acquire, or to take a water supply or an additional water supply, or to take or condemn lands for any new or additional sources of water supply, until such person, corporation or civil division has first submitted the maps, plans, and profiles therefor to the commission of conservation, as hereinafter provided, and until said commission shall have approved the same, or approved the same with such modifications as it may determine to be necessary as hereafter provided. Approval shall not be necessary of any plans heretofore approved by the state water supply commission, or of any plans or work for a new or additional water supply or filtration plant authorized in pursuance thereof or in connection therewith, or of any plans or work for the extension of supply or distributing mains or pipes of a municipal water supply plant into and for the purpose of supplying water in any territory within the limits of the municipality owning such plant, including territory which has not been heretofore supplied with water by such plant.

§ 522. **Petition for approval of plans for water supply and proceedings thereupon.** Any municipal corporation or other civil division of the state, or any person or waterworks corporation, may make application by petition in writing to the commission for the approval of its maps, plans and profiles of such new or additional water supply or for such new or additional source or sources of water supply. Such application shall be accompanied by an exhibit of maps of the lands to be acquired and profiles thereof showing the sites and areas of the proposed reservoirs, a plan of the other works proposed to be constructed, the profiles of the aqueduct lines and the flow lines of the water when impounded, maps, plans and surveys and abstract of official reports relating to the same, showing the need for a particular source or sources of supply and the reasons therefor, the plan proposed for protecting the new supply and watershed from contamination, or the proposed plan for filtering such new supply, and such application shall be accompanied by a plan or scheme to determine and provide for the payment of the proper compensation for any

and all legal damages to persons or property, whether direct or indirect, which will result from the acquiring of said lands and the execution of said plans. Such petition shall also be accompanied by such proof as to the character and purity of the water supply proposed to be acquired as the commission shall require. If such petition is made by a person or waterworks corporation, it shall be accompanied by an undertaking in such amount and with such sureties as the commission shall determine, that such person or waterworks corporation will pay the expenses of the hearing and determination as hereinafter provided. Said commission shall thereupon cause public notice to be given that on a day therein named it will hold a public hearing at the office of the commission in the city of Albany, or at such other place as it may particularly specify in said notice, for the purpose of hearing all persons, municipal corporations or other civil divisions of the state that may be affected thereby. Such notice shall be published in such newspapers and for such length of time, not exceeding four weeks, as the commission shall determine. At any time prior to the day specified in such notice any person or municipal corporation or the proper authorities of any civil division of the state may file in the office of the commission at Albany objections to the project proposed by such application. Every objection so filed shall particularly specify the ground thereof. Said commission shall, upon the day specified in said notice, or upon such subsequent day or days to which it may adjourn the hearing, proceed to examine the said maps and profiles and to hear the proofs and arguments submitted in support of and in opposition to the proposed project, but no person, municipal corporation or local authorities shall be heard in opposition thereto except on objections filed as authorized by this section. The commission shall determine whether the plans proposed are justified by public necessity, whether they provide for the proper and safe construction of all work connected therewith, whether they provide for the proper protection of the supply and the watershed from contamination or provide for the proper filtration of such additional supply, and whether such plans are just and equitable to the other municipalities and civil divisions of the state affected thereby and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water supply, and whether said plans make fair any

equitable provisions for the determination and payment of any and all legal damages to persons and property, both direct and indirect, which will result from the execution of said plans or the acquiring of said lands. The commission shall within ninety days after the final hearing and with all convenient speed either approve such application, maps and plans as presented or with such modifications to be necessary to protect the water supply and the interests of the applicant or of the inhabitants of the territory supplied by it with water, or the water supply and interests of any other municipal corporation, or other civil division of the state, or the inhabitants thereof, or the water supply and interests of any other person or waterworks corporation, engaged in supplying water to any other municipal corporation or other civil division of the state or the inhabitants thereof; or to bring into co-operation all municipal corporations, or other civil divisions of the state, which may be affected thereby; or to make just and equitable the submitted plan or scheme to determine and provide for the payment of the proper compensation for any and all legal damages to persons or property, whether direct or indirect, which will result from the acquiring of said lands and the execution of said plans, or to make safe all dams or reservoirs to be constructed by said plans; or it may reject the application entirely or permit another to be filed in lieu thereof, but it shall, however, make a reasonable effort to meet the needs of the applicant, with due regard to the actual or prospective needs and interests of all other municipal corporations and civil divisions of the state affected thereby and the inhabitants thereof. Whenever the commission shall make a decision on any application submitted to it, it shall state the same in writing and, if it approves, shall cause the same to be signed and the official seal of the commission affixed thereto and file the same, together with all plans, maps, surveys and other papers or records relating thereto in its office. The decision of the commission and its action on any application may be reviewed by certiorari proceedings. The expense of any such hearing and determination by the commission shall be certified by said commission to the person, waterworks corporation, municipal corporation or other civil division of the state making such application and shall be paid by said applicant within thirty days thereafter upon the certificate of the commission to the persons entitled thereto.

§ 523. **Approval of work.** No new water supply system, built in accordance with plans hereafter approved by the commission, shall be operated until the work has been approved by it.

§ 524. **Water supply to be used in other states.** No waters of this state shall be diverted without the state.

§ 525. **Sewage disposal as affecting potable waters.** The commission shall report the present disposition of sewage of each municipal corporation and other civil division of the state, and, if necessary, of adjoining state, with special reference to said disposition affecting the various municipal corporations and other civil divisions of the state in relation to the water supply of this state. Said commission shall also report the advisability of, the time required for, and the expenses incident to the construction of a state system of water supply and for a state system for the disposition of sewage, if necessary, for all or any of the municipal corporations and other civil divisions of this state, and make such recommendations connected with the subjects of said investigations herein provided for as said commission shall determine. In said investigation concerning either the water supply or disposition of sewage, said commission shall, so far as possible, make use of all reports and surveys in regard thereto which have heretofore been made. Wherever, by any provision of law, the consent or approval of any state board, officer or commission is required for the construction of any sewage system or sewage disposal works, the further approval thereof by the conservation commission shall be required.

## ARTICLE 10.

### LAWS REPEALED; WHEN TO TAKE EFFECT; SAVING CLAUSE.

Section 550. Laws repealed.

551. Saving clause.

552. When to take effect.

§ 550. **Laws repealed.** Of the laws enumerated in the schedule hereto annexed, that portion specified in the last column is hereby repealed; and all acts and parts of acts, both general and special, or local inconsistent with this act are hereby repealed.



§ 551. **Saving clause.** Nothing contained in this chapter shall be deemed to supersede or repeal any provision of the navigation law.

§ 552. **When to take effect.** This chapter shall take effect immediately.

SCHEDULE OF LAWS REPEALED.

Laws of	Chapter.	Section.
1909.....	24.....	187, 188, 195-204, 207, 208, 210-215, 224
1909.....	56.....	1-26
1909.....	240.....	30
1910.....	285.....	All
1911.....	36.....	All
1911.....	142.....	All
1911.....	420.....	All

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**APPENDIX F.**

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**REPORT OF THE CONSERVATION COMMISSION ON  
THE WATERSHED OF THE GENESEE.**

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## APPENDIX F.

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### REPORT OF THE CONSERVATION COMMISSION ON THE WATERSHED OF THE GENESEE.

#### *To the Legislature:*

The conservation law, section 21, requires the Commission to investigate the character of the waters, outside the canal system, in each of the principal watersheds of the State and of the uses thereof and to report from time to time the results to the Legislature. It is specially directed that the investigation set forth the privileges heretofore granted for use of these waters; the terms and conditions thereof; whether the privileges are revocable, the conditions complied with or the terms expired; to investigate and report as to the diversion rights heretofore acquired by the State, and as to the use being made of the waters subject thereto.

This report omits particular discussion of those parts of the watershed which would not be affected by any of the several plans of water conservation which have received serious consideration and it deals with canal waters, only to the extent of diversion rights acquired but not used now, for canal purposes, and to the extent that regulation of the Genesee would be related to present plans for canalizing the Genesee at Rochester.

The section cited from the conservation law provides that any improvement plans, to be recommended by the Commission, shall present a comprehensive system for unified development for each watershed to the end, among others, that the rights of the State be asserted and utilized so as to combine the most effective service with the production of the largest net revenue and public benefit to the State which may be practicable. An effort has been made to present all facts bearing on the opportunity for realizing these aims of the conservation law.

#### GENERAL PHYSICAL FEATURES.

This watershed is one which has undergone those ultimate modifications of natural conditions which follow settlement. The greater part of the territory has been cleared of forest, the streams

for many years past have been free of those natural obstructions to run-off incident to wooded tracts and, below the surrounding hills, which extend generally from Mount Morris to the Pennsylvania line, the surface is largely under plow. Above Rochester the shed averages thirty miles in width. From the Pennsylvania line northerly to Mount Morris the descent of the river bed and of its tributaries is rapid. The main valley offers opportunity for large flood storage immediately above Portage Falls, as does the river gorge below. From Mount Morris to Rochester, extends a plain from which the river makes at Rochester a sharp drop to the Lake Ontario level. At Portage, in the gorge and at Rochester permanent hydraulic power of great value will arise if the river flow is regulated above. At Lake Ontario the Genesee leaves the State in a pondage too large to be affected by storage operations in the watershed. The ultimate source of the main channel of the Genesee is at a point in Pennsylvania about ten miles southerly of the New York line. But the part of the shed without the State is very small and would not be affected by any probable plan of New York for conservation work. The Genesee shed, therefore, involves no complications with neighboring states, and New York enjoys a free hand as to conservation work here. It follows that New York would reap the whole benefit to follow such work.

#### SOVEREIGNTY AND LAND TITLES.

The whole of this watershed lying within this State is embraced within the territory which was the subject-matter of the treaty of Hartford, entered into between the States of Massachusetts and New York. The rival claims of these States to that territory survived the Revolutionary War, but were settled in 1786, subject to the rights of the Indians who then held complete occupation. By the treaty New York ceded to Massachusetts and to her grantees, their heirs and assigns, the right of pre-emption from the Indians, and all estate, right, title and property in the land. There was no express mention made of waters or lands thereunder. Massachusetts ceded to New York all right of government, sovereignty and jurisdiction. Massachusetts, therefore, acquired by the settlement such property interest, but only such, as a private grantee would be competent to take from

a sovereign grantor. There was reserved, however, by New York a mile wide strip along Niagara river. Massachusetts, in 1788, granted, by one sale, the property interest acquired by her in the lands adjoining the east line of her holding, and extending to the Genesee and including the so-called mill yard tract being twelve by twenty-four miles adjoining Lake Ontario and the west side of the Genesee, to Phelps and Gorham, private purchasers. In 1791, Massachusetts granted the remaining land in the watershed so far as it adjoins the west side of the river and extending south to the Pennsylvania line, by one sale to a private purchaser, Robert Morris.

The physical importance of the Genesee channel was thus recognized by making it a boundary in the first great private property division. At the time of those sales the rights of the occupant Indians were acquired by the grantees of Massachusetts with the consent of the Federal government, excepting several small reserves. Many of these also adjoined the channel of the Genesee. The Indians, a few years later, yielded up those reserves to the holders of the pre-emption right. All outstanding private titles to the territory in this watershed to-day are like titles would have been if derived by patents made in 1786 directly by the State of New York to private grantees. New York retains the same sovereign interest and holds for the benefit of the public at large, the same rights in these waters as would have survived original patents made by New York in that year, to private grantees of public domain.

The State and its political subdivisions hold to-day in full proprietorship, extensive tracts and easements to flow and to divert flow, since acquired by purchase or eminent domain, and these will be set forth at length in another place. No grants have been made to date, under the general statute of New York permitting grants of land under water to be made by the Commissioners of the Land Office, of any such lands within this watershed excepting two affecting the Lake Ontario level of the river and made to facilitate railroad docking.

No Federal legislation specially affects the waters of the Genesee except that there has been established a harbor on the Lake Ontario level at its mouth. That level is below the area

where any control over river flow could appreciably affect or injure Federal or private riparian interests. The Genesee does not invite consideration as a through waterway susceptible of improvement for modern interstate commerce. The exercise of Federal power to improve the Genesee channel within this State for navigation purposes, is too improbable to constitute an obstacle to improvement plans on the broadest lines which might attract New York in the way of a State undertaking.

Direct special grants made by the Legislature, carrying privileges in the waters of the Genesee shed, are numerous and cover a period from 1798 to a very recent year.

It seems to be a settled rule, with exceptions not applicable to this watershed, that, in the absence of an express reservation, a grant from the State carries, along with upland, title from the shore on each side to the center of a navigable fresh water stream. Under that rule, title to the beds of the Genesee and its tributaries would be in private hands, except where title may have returned to the State by escheat, purchase or condemnation. Private title, however, is subject to a public right of user of the channels, upstream at least to the head of navigation limits. The right of the State to insert navigation dams and locks at falls, dangerous for boats, and, as against private riparian owners, to retain the power incidentally created, has long been recognized. But the range of liability to be incurred and the range of benefits to inure to the public, in case of stream regulation by the public solely to create or improve power, is not so certain. Such projects, as State undertakings, designed for Statewide benefit are untried and are surrounded with difficulties equally as perplexing as are projects for such regulation by private enterprise for private benefit. Private users of the power of navigable streams at many sites insist that they are not enjoying a privilege, but exercising a right. This increases the uncertainty as to the reward to be gained by the State from regulation through State agency or at State expense. In this situation, preliminary inquiry into these private uses and into the facts bearing upon the public right from the earliest times and into the extent of present public land holdings along, and of easements in these streams, becomes important. An application under the river improvement

law of 1904 to have a storage dam constructed on this river, was denied by the State Water Supply Commission in 1911, because, among other reasons, the Commission was in possession of no data as to the rights of the State nor of data supporting claims made by power users at Rochester to the power of the river and which power they asked to have assessed as theirs under a plan of assessing direct benefits to defray the expense. As local assessments based on direct benefits to either public or private property, to result from regulation as a public project, may be a just means for meeting the whole or part of the cost, it is of great importance to public interest that the line be properly drawn between what is public and what is private property. To assess water power values as private property, if they are not, would be embarrassing if not fatal to any future attempt on the State's part to take a different position on the matter of such ownership.

The following tables set forth the various sites which were early developed for hydraulic uses in the Genesee watershed; their history in brief and the legislative authority for diversion of the water for private use. The tables cover all natural power sites in the main channel of the Genesee and its navigable tributaries which have been treated by any one as practically available for power:



*Hydraulic Developments for Private use in Main Channel, Genesee River, Legalized by General Statute for no Definite Periods.*

Site	Legalizing Act		Conditions imposed	First developed 1828.....	Development In use 1911.....	Channel Unsafe for navigation.	Remarks
	L. 1798, ch. 2-22, Sess.	L. 1801, ch. 186, § 34. L. 1813, ch. 47, § 2.					
Crest, lower fall.			Non-interference with navigation.				
Upper step, lower fall.			"	1817.....	"	"	"
Central Flats...			"	About 1830.....	Not existing 1911	Probably never navigated.	

A  
Rochester

*Hydraulic Developments for Private use above Main Fall in Main Channel, Genesee River, Legalized by General Statute for no Definite Periods.*

Site	Channel & high-way		Legalizing Act	Conditions imposed	First developed	Development All in use 1911..	Channel Unsafe for navigation.	Remarks
	L. 1798, ch. 2-22, Sess.	L. 1801, ch. 186, § 33. L. 1813, ch. 47, § 1.						
Main fall (Central ave. dam).			L. 1798, ch. 2-22, Sess. L. 1801, ch. 186, § 34. L. 1813, ch. 47, § 2.	Non-interference with navigation.	West side mill, 1807. East side mill, about 1810. West side race, 1815. First dam, bank to bank, 1812.			No lock.
Upper fall (Johnson and Seymour dam).			"	"	West side mill, about 1802. East side mill, 1808. West side race, 1817. East side race, 1817. Dam, bank to bank, 1817.	"	Site of dam navigated previous to 1817.	"

B  
Rochester

\* After destruction of Allen's mill.

*Hydraulic Development for Private use in Main Channel, Genesee River, between Rochester and Transit Bridge, (Allegany County) Legalized by Special Acts Expressly Repealable.*

Town	Site	Channel a high-way	Legislating Act	Licenses	Develop-ment	Use ceased	Conditions im-posed	Remarks
York.....	Lot 79.....	L. 1798, ch. 2, 22, See. L. 1801, ch. 186, § 33. L. 1813, ch. 47, § 1.	L. 1833, ch. 106.	Erastus Bailey.....	Not in use.	1901.....	Lock.....	No lock.
Genesee.....	River bridge....	"	L. 1835, ch. 109.	W. H. Spenser et al.	In use....	"	"	No lock but an apron.
Leicester.....	Leicester bridge	"	L. 1835, ch. 213.	Felix Tracy et al....	Not in use.	Before 1860.	"	Dam out.
Mt. Morris.....	Village of Mt. Morris.	L. 1818, ch. 51, §§ 2, 3.	L. 1826, ch. 181, and amendments.	W. M. Mills et al....	In use....	"	Lock canal....	No boat canal and bonds not renewed.
Castile (Co. line)	"Queer Waters" ..	"	L. 1827, ch. 104.	Obel Spellman et al.	Not in use.	Before 1860.	Apron or lock.	Dam out.
"	Lot 13, E. side to lot 76, W. side.	"	L. 1826, ch. 208.	George Wilson.....	"	"	"	"
"	Lot 76 near Wolf creek.	"	L. 1828, ch. 83.	R. M. Curtis et al.	"	"	Lock.....	"
Portage (co. line)	Lot 148 to lot 89.	"	L. 1827, ch. 106.	Joseph Fisher.....	"	"	Apron or lock.	"
"	Lot 153 below large fall.	L. 1828, ch. 250.	L. 1825, ch. 93.	W. M. Rogers et al.	"	"	"	"
Portageville.....	Lot 165.....	L. 1818, ch. 51, §§ 2-3.	L. 1828, ch. 155, L. 1828, ch. 250.	L. C. Foot et al. . .	In use....	"	None.....	No lock.
Hume.....	Lot 236 to lot 110	"	L. 1827, ch. 14..	Sylvanus Dixon et al.	Not in use.	Before 1860.	Apron or lock.	Dam out.
"	Lot 24 to lot 46.	"	L. 1838, ch. 316.	Levi Rice et al....	"	"	Apron.....	"
Canadua.....	Lot 12 to lot 13.	"	L. 1823, ch. 168.	J. S. Raymond et al.	"	"	Apron or lock.	"
"	Lands of Rice and Clement..	"	L. 1825, ch. 197.	Jos. Rawson et al.	"	"	"	"
"	Lot 4.....	"	L. 1825, ch. 165.	Loring Francis et al.	"	"	"	"
"	Lot 5 to lot 6....	"	L. 1843, ch. 196.	Elias Smith.....	"	"	Apron.....	"
Belfast.....	Lot 1, W. side to lot 2, E. side.	"	L. 1826, ch. 156.	Samuel King et al.	In use....	"	Apron or lock.	Apron.

Livingston County

Allegany County

*Hydraulic Developments for Private use in Main Channel, Genesee River, above Transit Bridge, Allegany County, Legalized by Special Acts Expressly Repealable.*

Town	Site	Channel a high-way	Legalizing Act	Licenses.	Develop-ment	Use ceased	Conditions im-posed	Remarks
Allegany County.								
Angellea.....	d'Autremont farm.	L. 1818, ch. 51, §§ 2-3.	L. 1833, ch. 86.	Louis Paul d'Autremont.	Not in use..	Before 1860	Apron or lock.	Dam out.
"	Smith's farm....	"	L. 1833, ch. 202.	Henry Smith....	"	"	Apron or lock if necessary.	"
"	Lot 49.....	"	L. 1837, ch. 226.	Phillip Church, Jr.	"	"	Apron or lock.	"
Amity.....	May's land.....	"	L. 1832, ch. 182.	Harvey H. May.	"	"	"	"
"	Church farm, Belmont.	"	L. 1833, ch. 188 (not expressly repealable).	John B. Church.	In use.....	.....	Apron or lock if necessary.	No lock or apron.
Scio.....	Palmer's saw-mill.	L. 1828, ch. 250.	L. 1928, ch. 202.	Benj. Palmer....	Not in use..	Before 1860.	Apron.....	Dam out.

D

*Hydraulic Developments for Private use in Main Channel, Genesee River, Legalized by General Act Imposing no Penalties.*

Town	Site	Channel a high-way	Legalizing Act	Conditions	Development	Channel
Allegany County.						
Wellsville.....	Wellsville.....	L. 1828, ch. 250.	L. 1828, ch. 250.	None.....	In use.....	Probably never boated.
Willing.....	Shongo.....	"	"	"	"	"

TRIBUTARIES,

*Hydraulic Developments for Private use on Black Creek Legalized Under General Act for no Definite Period.*

Town	Site	Channel a high-way	Legalizing act	Conditions imposed	Development	Channel	Remarks
Montgomery County.							
Chili.....	Chili.....	L. 1813, ch. 47, § 1.	L. 1813, ch. 47, § 2.	Non-interference with navigation.	In use.....	Boatable.....	No lock or apron

*Hydraulic Developments for Private use in Canaseraga Creek Legalized by Special Acts for no Definite Periods, not Expressly Repealable.*

Town	Site	Channel a highway	Legalizing act	Licensee	Development	Use ceased	Conditions imposed	Remarks
G Livingston Co.	Groveland.....	L. 1801, ch. 186, § 33.	L. 1820, ch. 65...	Isaac Havens...	Not in use...	About 1880.	Lock.....	Dam destroyed
	W. Sparta.....	"	L. 1811, ch. 106. L. 1813, ch. 47, § 34.	Hugh McNair...	"	Before 1860.	Lock and canal 16 ft. wide.	No existing dam.

*Hydraulic Developments for Private use in Canaseraga Creek Legalized by General Acts for no Definite Periods.*

Town	Site	Channel a highway	Legalizing act	Conditions imposed	Development	Use ceased	Remarks
H Livingston Co.	W. Sparta.....	L. 1798, ch. 2, L. 1801, ch. 186, § 33.	L. 1798, ch. 2, L. 1801, ch. 186, § 34.	Non-interference navigation..	Not in use.....	1910.....	Dam went out in 1910.

*Special Privileges Granted to Corporations for Hydraulic Developments in Genesee River.*

Licensee	Site	Channel a highway	Granted by	Conditions imposed.	Development	Use proposed	Remarks
Genesee River Co	Portage and others.	L. 1828, ch. 250, L. 1818, ch. 51, §§ 2-3.	L. 1898, ch. 605, and amend'ts.	Time limit.	Never made....	Both public and private.	Company dissolved and rights declared forfeited in 1911.
Mt. Morris Water Power Co.	Gorge.....	L. 1818, ch. 51, §§ 2-3.	L. 1903, ch. 564.	None.....	"	Private.	Project apparently abandoned.
Town of Mt. Morris (municipality).	Mt. Morris.....	"	L. 1897, ch. 316.	"	Made by Mt. Morris Water Power Co.	Public.	Outstanding privilege apparently us less.

I

## USES OF THE GENESEE AND ITS TRIBUTARIES.

This river and several of its tributaries, for considerable distances, were in constant use, by the natives, as public ways, not only for local communication, but the Genesee and the Canaseraga, as thoroughfares also via the Susquehanna to and from the Chesapeake country, and the Genesee and Black creek, coming from the southwest at the point of Belfast, via the Allegany, to and from the Ohio country. That same use was continued by white explorers and later by white settlers for a long period and is described with much detail in records left by early proprietors of the land and by early writers. Permanent settlements within the Genesee country by whites began in the decade between 1790 and 1800, but in the year 1800 few families had located there. In the Documentary History of New York, published under State authority, are extended accounts of the Genesee country written at the time when settlements began. The opportunity for navigation was considered quite as important as the question of soils and the utility of the Genesee system was at once recognized. The Genesee is there described, 1793, as affording a water communication from almost every township in connection with different branches of the Chemung river, into the Susquehanna and thence to Philadelphia. This route was available, by a 12-mile portage over the dividing summit, for boatloads of ten to fifteen tons, from the interior parts of the Genesee country. In 1792 there were no settlements, apparently permanent, anywhere in the Genesee country, and at the site of Rochester was but a single store and tavern. The means whereby settlers penetrated the interior of the valley in the year 1798 was by waterways exclusively. The Canisteo, a branch of the Chemung leading into the Susquehanna and rising just over the divide from the Genesee shed, was navigable almost to its source in a marsh where the Canaseraga also rises. At this point boats of ten tons downstream capacity could approach within nine miles of each other, and by a portage used in high water the distance was reduced to five miles. The first proprietors of the original large tracts of the Genesee country encouraged settlers, by providing boats to carry to the Chesapeake, crops in demand at that market. The type of boat earliest used by settlers was the batteau, a favorite

with Canadian settlers, but it was superseded in the Genesee and Susquehanna shed by the ark, which was constructed by combining a raft and a roof, both made of lumber previously cut into marketable shape. In these arks 300 barrels of flour from the Genesee country would be taken to the Chesapeake, and instances are recorded where cargoes of 500 barrels of flour were floated down the Canisteo. The village of Arkport, Steuben county, now marks the scene of this traffic. To reach the divide from the lower parts of the Genesee country, the Genesee river and its main tributary, the Canaseraga, were used. From the fording place across the Genesee, situate perhaps fifty rods above the present canal aqueduct at Rochester, the Genesee was then navigable for boats large enough for freighting, to the Canaseraga, and thence, for twenty-five miles further up the Genesee channel, to the first Portage fall. By making a portage at these falls, and thence following the Genesee channel to Black creek, the present site of Belfast, and thence up that creek southwest, a short portage carried traffic into Oil and down Olean creeks leading into the Allegany. Boating which paralleled these natural routes was continued during the days of the Genesee Valley canal down to the year 1877. Until the Erie canal project took definite form, about 1817, it was believed in the Genesee country that its commercial outlet to the seaboard would always be down the Susquehanna, the traffic to be floated over a system of natural waterways. Improvements of channels were expected in due time. In 1810, DeWitt Clinton, while making a personal inspection of the opportunities for water communication from the Hudson to Lake Erie, noted in his diary that the Genesee was navigable for forty miles above the fording place (now Rochester) to the Canaseraga and thence up the latter stream for ten miles. Two other tributaries of the Genesee also served the first travel in other directions. They were Black creek, which flows through the town of Riga, in Monroe county, and was followed for several miles to the west, and at one time considered of such importance as to be deemed available for canalization as a connecting link in carrying the proposed Erie canal to the Niagara, and Oatka or Allen's creek, flowing through the town of Wheatland, in Monroe county. As late as 1839, the Legislature directed that the local highway

officials construct and keep in repair a public towing path along the south side of Oatka creek for a short distance above the Genesee Valley canal feeder dam at Scottsville. Navigation of the Oatka, from Scottsville to the Genesee, had already been provided for by a canal to serve in place of a necessary portage. This canal was constructed by a private company, specially chartered in 1829.

At the time of the first legislation protecting these natural waterways, enacted in 1798, their channels were in the condition which nature had given them. While the desirability of stream improvements for public uses was, of course, recognized, this early legislation proceeded upon the idea that as against diversion or encroachment by riparian owners the natural condition of the channel was what the public was entitled to insist upon and there the line was drawn. It is difficult to realize that many of our streams when compared to-day with modern facilities could, in their natural condition, have ever been practicable for useful navigation. The difficulty disappears when the greater obstacles to early travel overland, encountered in forests which covered the land, are considered. Through these forests nothing could be transported on wheels. It was many years, after the date of the first settlements in the Genesee country, before there were other means than boating to get into the country, or to get its products to market, or for traveling long distances. Packets, using the Erie canal, passed up the Genesee soon after 1822 as far as the Canaseraga, using a channel unimproved above the feeder pond at the village of Rochester. Prior to 1834, a small flat-bottom steamboat plied the Genesee from Rochester to Mount Morris, and in that year a company was incorporated to take over the business. The line was continued for a few years. The first legislation in exercise of public dominion over streams like the Genesee, was chapter 67 of the Laws of 1786. It authorized grants to owners of adjacent lands, by the Commissioners of the Land Office, and in aid of commerce, of the lands under water of the rivers of the State. That act authorized and encouraged the building of durable and desirable docks and piers by private enterprise. In 1818 lakes, which had not been included in the scope of the former act, were brought within it. Commerce and

navigation on the Genesee were first protected by the act of 1798 which undertook to define the limits over which many natural streams, then of first importance, should be respected as public highways. For several years, from that time on, common roads and inland navigable streams were treated together under the head of highway laws. The law imposed the same penalty for obstructing either. The first legislation dealing directly with hydraulic uses of streams was also embodied in the act of 1798. When that act was passed there was but one mill in the Genesee watershed, at a point then called Hartford, now Avon. That mill was soon thereafter abandoned, but it served the travelers crossing the Genesee by a main Indian trail, which subsequently became the line of the main State road. There had been but one earlier mill erected on the Genesee. It stood above the falls at the site of Rochester on the west bank of the river. That mill, with its small wing dam, erected in 1789 by the first white inhabitant of the locality, fell into ruins within three or four years thereafter. A main public concern in 1798, and for long thereafter, was to preserve unobstructed the navigation of available waterways. It was the fear of obstruction which became the occasion here for the first legislative assertion of the public right in streams. Our experience differed apparently from England's only as to the occasion for acting. In England, according to Magna Charta, in its condemnation of fish-weirs, it was interference with the public right of fishing which was the occasion for solemn assertion of the public right. Here, therefore, the test for determining whether the public right attaches, has been the utility of the flow for boating, channel obstructions being removable and rapids reducible by locks. Our act of 1798 was, as its terms clearly indicate, the result of a purpose to prevent that interference with boating which is inseparable from hydraulic structures in and diversion from natural channels. Either the water-wheels or the boats must yield all the time, or the one must take turns in yielding the flow to the other. The practical construction given to that act of 1798 by all persons then affected and for some two generations, reveals our policy, earliest declared, as to the division between the public and private uses of navigable waters. That policy did not conflict with the riparian owner's right of



direct access to the natural highway for boating nor with his enjoyment of any uses which have been held as a common right in public waters. The act of 1798 was confined to the streams lying westerly of the territory under white settlement at the time of the Revolution. In that wilderness the Legislature could assert its jurisdiction to protect the public right without disturbance to hydraulic structures for there was scarcely one then existing to be disturbed and none on a site now in use in the Genesee shed or which has been used in nearly a century past. Under the policy reflected in that enactment, and within the thirty years which followed, practically every available power site, so far at least as the Genesee shed was concerned, was first developed to the extent deemed warrantable. It was after the greater number of these early developments were made that the justice of the policy or power of the State to adopt its policy was challenged. It was at the other end of the State where the question first arose.

The act of 1798 defined the public highway over the Genesee to extend from the great fall (main fall at Rochester) to the Canaseraga creek, and from that point up the Canaseraga to a point now close to and below the village of Dansville. This act, enacted after the lands adjoining these channels had become private property, was ineffective, no doubt, to extend a public use upstream beyond the point where the flow was sufficient for boating. The then existing circumstances exclude the inference that the Legislature had, in 1798, in 1801 or in 1813, when these provisions were re-enacted, any purpose to confiscate or invade private rights. These acts did not, in an attempt to make the channels navigable, declare them so, but being navigable and having been navigated, to dedicate the channels as public highways. If in case of some streams, the Legislature went up-stream too far, in others it did not go as far as it might, as later shown herein. In 1798 it was to the interest generally of private owners of riparian lands to have navigable channels adjacent, preserved as outlets directly accessible to them. The situation of the territory at that time indicates a purpose in the act of 1798 to preserve to the public what it was then enjoying, and, so far as the act would do so, to warn all persons not to invade these channels with hydraulic structures for private uses and incon-

venience commerce. But if a declaratory act would not operate to deprive a private landowner of his rights in such a stream above the real limits of navigation, a channel below that point, which was not protected against intruders by such a warning, but which was in fact navigable and navigated, remained subject to the public use because of the fact of its sufficient flow. Since the act of 1813 did not extend to many streams in other sheds and which were navigable beyond question, section 23 of the act of that year was enacted, which reads as follows:

"And be it further enacted that nothing herein contained shall be construed to prevent any other stream or waters to be declared public highways, nor to affect or prejudice the rights of the people of this state to such as were at the time of the passing hereof, public highways."

The list of streams expressly protected in 1798 was extended in 1813 to cover the Black creek in the town of Riga from the Genesee to the mill of Samuel Baldwin, a point about two miles southeast of the present village of Churchville. By independent act of 1818, similar protection was extended to the Genesee channel from the Canaseraga creek to the bridge on the edge of Angelica, excepting the Portage falls. By independent act of 1839 similar protection was extended to the channel of Oatka creek from the State's feeder dam to the railroad bridge across the creek, a tramway bridge which crossed the creek a quarter of a mile higher up, at the site of the Scotsville mills. Both Black and Oatka creeks, being practicable for boating of the early type, beyond the limits named, the Legislature, in these two instances, extended to the mills above, which had been previously erected, a consideration which the builders could not have enforced. By independent act of 1828 the Portage falls and the remainder of the Genesee channel to the Pennsylvania line were similarly protected. Whether or not a public right in the Genesee channel above the Angelica bridge could be sustained to-day as against riparian owners may be passed over as unimportant to the cause of conservation at least, because that channel lies outside that section of the river to be affected by any probable project within that watershed, or by any plans which have heretofore been considered. No project has involved pondage or stream regulation above Fillmore.

The act of 1798, re-enacted in 1801 and finally in 1813, since which this law has stood unrepealed (except as it has been superseded by laws for canal improvements affecting channel sections), in imposing penalties for the damming of streams with structures which necessarily blocked through navigation and diverted natural flow from natural channels available for boating, were enacted under a power commonly exercised in some form by all nations possessing streams useful in their natural condition for navigation. The provision which, where locks were inserted or where boats were not delayed by dams, gave protection against the penalties, was enacted on the manifest theory that no private owner of land adjoining such channel was entitled, on the strength of that ownership or of title to the bed, to dam or to divert any part of the flow away from that channel. The rule as between upper and lower riparian neighbors in respect to diversion and return of stream flow has, of course, no bearing on rights as between riparian owners and the public, in respect to navigable channels. The waiver of penalties in case of mills erected or commenced before October 10, 1798, the date the act passed, had no effect along the Genesee, because at that time no dams, excepting the temporary dam at Hartford, existed thereon. The provisions of the general acts waiving penalties where locks were inserted and navigation not impeded were necessarily repealable. The numerous private acts legalizing private dams were nearly all made expressly repealable at the will of the Legislature. All the acts were, on their face, intended as temporary concessions, at the inconvenience of the wider public, to accommodate new settlements in procuring lumber and flour. The clause giving exemptions from penalties and extending these privileges were not framed in language suggesting that rights, as against the State, in the power, were being lodged in the beneficiaries, although they did create rights as against all others. The legislation also saved the man, who, acting under it, constructed a dam in, and diverted the waters from a naturally practicable channel, from liability for the penalties arising in the creation of a nuisance in public waters. In later years these acts were amended, and special acts passed, to extend to other streams, some perhaps not boatable. In several such instances where it was desired to

float logs from headwaters to market on impounded water the acts were held invalid on the strength of a finding that the channels had never been naturally navigable. Since the time of these decisions, there has been little respect extended to the earlier acts which applied to many channels navigable of common knowledge. Since all the lands in this watershed had, previous to 1798, passed out of the proprietorship of the State without express reservation of any streams, and since every stream becomes at some point too small for navigation, the upstream limit of the public right remains, theoretically at least, and no doubt practically, an uncertain point on any channel. Only a comprehensive judicial proceeding against all riparian owners could locate this point conclusively for all time on any stream. It follows that the private owner of land bordering the Genesee, at a point where the question has not been raised and settled between the public and the riparian owner, may to-day dispute the fact and litigate the question with the State. It is hard to believe, however, that a judicial inquiry held to-day would result in a finding that the Genesee from Lake Ontario to Belfast is not a naturally navigable channel, if the record of its public use from earliest times to that point or beyond is considered along with the fact of its protection by statute from the beginning of settlements to this day. The public right is kept good by the rule that, as to a naturally navigable channel, it is never lost by nonuser. Under a supplementary rule the sovereign, in the absence of constitutional warrant, is incompetent to permanently abdicate by any original patent or subsequent special grant to private persons, for private purposes, in perpetuity at least, its interest in, and its duty to protect the public navigation right. This right may be for a period relatively unimportant when other modes of travel and intercourse are compared, and it may result, as it generally has, in failure to use such streams and to prevent invasions of the channels. In the case of the Genesee, protection of the navigation right has been ignored as largely as it has elsewhere in the State due first, in time, to the opening of practical upland roads and, later, to the construction of a paralleling canal and to very extensive railroad construction. During the period of operation

of the Genesee Valley canal which paralleled the Genesee from Rochester to Belfast, and depended on the flow of the Genesee, the giving of hydraulic privileges in the Genesee channel ceased. Now, however, and since the gas engine is perfected and used in motor boats, a great number of such boats, as well as other types of pleasure craft, traverse the Genesee for miles above Rochester. Any question as to the nature of the public right in natural channels could not well be settled for any purpose on the assumption that the right would never be of importance hereafter in support of navigation, for, where available streams have existed in older countries, elaborate systems of canalization have, sooner or later, been undertaken. It has been held that there is a riparian right to divert public water from its channels for power at points not actually used by boats in streams generally navigable, and to divert surplus water at boatable points if use of the power was not expressly reserved to the public in original land grants. On the other hand, as to certain rivers, it has been held that the public may divert the flow for public purposes as against a riparian owner below, and without rendering any compensation. The increasing value of the use of water has thus far prevented acquiescence of all interests in either of these views. Neither of them is easy to harmonize with certain natural rights of the public and of private landowners. No such conflict arises if we recognize that a natural watercourse may not be diverted by the public without liability for such special injury as the riparian owner below suffers. If the flow is sufficient for boating, whether safe or not, the public may justly insist that the flow be undisturbed precisely as the owner of a precipitous shore might be unable to reach and use the stream but he would, nevertheless, have the right to insist that the flow be undisturbed. If then the public diverts a flow which is sufficient for boating, it is not liable to the riparian owner below for the value of its use for power because such owner did not possess the right to it, but the public is liable to him for depreciation of his property, whatever that may be, due to the loss of direct access to the stream for boating and for other common uses. That value of the location for enjoyment of common uses in the water was not put there by the public and it should not be taken away by the public, wholly or in part, with-

out compensation to him, and this is true regardless of the purposes of the public in diverting the flow from its natural bed. Certain early cases on this subject, where power developments made under special legislative privileges were not involved, assigned power uses on boatable streams to riparian owners because it was considered that the public could have no use for hydraulic power. That view also fitted in with the view that government was incapable of using directly hydraulic power, and that to make the value of that use a source of public income, through franchises, could never be entertained as a public policy.

Of the legislative acts which authorized dams as a special privilege, extended to individual beneficiaries by name, and enacted from 1798 to 1843, and affecting the Genesee watershed, twenty-five in all (see tables C. D and G, *supra*), but seven contained any provision for keeping the privilege good in favor of heirs or of assignees. The beneficiaries, under the early statutes relating to the Genesee watershed, are presumably dead and the privilege terminated, because where the privilege was merely personal it would terminate on death. Of these twenty-five personal privileges all but three were made in terms expressly repealable, a proviso inserted from abundant caution on the part of early Legislatures. Eight acts contained the proviso that the waters affected might be retaken for internal improvements, either navigation, manufacturing or both, with no liability for damages on the part of the State. All but two of these twenty-five acts contained the proviso that the beneficiary should construct some appropriate device to preserve a thoroughfare for free navigation of the channel. None of these acts has ever been repealed in terms, nor has exemption from the penalties imposed by the general act been removed. Many applications were made for privileges at other sites, which were not granted. Of the dams now remaining in channels both safe and practicable for boats, only two do not conform to the requirements of the statutes which license them or would obstruct boating. The privilege granted in 1903 to the Mount Morris Water Power Company for private purposes, contained a clause which no doubt operated to revoke earlier privileges to be affected at the site to be chosen between Silver lake outlet and St. Helena. In

the special charter granted to the Genesee River Company, passed in 1898, and since declared forfeited on suit of the Attorney-General, section 12 was no doubt intended to operate as a revocation of all earlier special privileges affecting the sites at which that company might operate. The Legislature having in this privilege to the Mount Morris Water Power Company, revoked old privileges to clear the way for the new one, a precedent exists for revocation of new ones and old ones to clear the way for developments by the State for public benefit. Not one of these outstanding privileges in the Genesee shed had its origin in any consideration, then passing presently to the State, or by way of obligation undertaken to perform service for the benefit of the public, although instances occurred in other parts of the State of privileges conditioned on public service to be rendered in the sawing of lumber, or grinding of wheat for all comers, at no more than the prevailing rate, or to erect and maintain forever, or for some definite period, improvements which would better the natural conditions of natural channels for through navigation. But the facts surrounding the giving of privileges in the Genesee shed exclude the inference that the Legislature expected thereby to secure improvements to navigation as compared with natural conditions. Several of the acts, for example, chapters 109 and 213, Laws of 1835, authorizing dams intended for hydraulic purposes, recite that the boat locks to be erected shall be no more hindrance to navigation than is inevitable from locks. Since so many of these acts were expressly repealable at the legislative will it is impossible to conclude that the Legislature or the beneficiaries understood that the structures to be erected would result in improved channels for navigation as compared with natural conditions. The personal privileges in case of the Genesee shed were in thirteen cases limited to dams of stated height, only one dam over four feet high being permitted. That these privileges were intended only as temporary concessions to localities seems reasonable from the fact that eighteen of them were abandoned over fifty years ago and that no dams have existed at the sites within that period. The widespread public interest existing in the early days against granting privileges to dam public channels, was recognized by the enactment of a statute in 1829 which

required applicants for privileges to publish locally a notice of their intention to apply to the Legislature. That requirement remained on the statute books until 1892.

#### FISHERY.

The public have not been confined in the past to a mere right of passage over these boatable channels. The right of fishery has been enjoyed by the public unquestioned over the whole extent thereof down to the present time.

#### MUNICIPAL USES.

The waters of the Genesee shed are extensively used by the city of Rochester for public purposes. The present use is founded upon authority granted by the Legislature in 1873 under which the city constructed storage works at the outlet of Hemlock lake and a pipe conduit from that point to the city, and another conduit has since been installed. The city possesses a similar authority to draw upon the waters of Canadice lake. The city was called upon to compensate riparian owners of lands bordering on Honeoye creek, through which these lakes overflow at a point above Rochester into the Genesee river. The water thus diverted by the city is largely lost for hydraulic purposes at the falls at Rochester. That total diversion averages at the present time 25 second feet. The city of Rochester also draws directly on the Genesee at Rochester in case of fire through a pumping system. The villages of Avon and Geneseo take water supplies through a municipal system from Conesus lake but not under legislative authority. No municipality between Rochester and Belfast draws directly on the channel of the Genesee for municipal supply. Lake Ontario is drawn upon near the mouth of the Genesee by a private corporation, through a pumping system, for sale of the water to its customers, some of whom are served under municipal franchises, and others in cases where such franchises are not required. The draft on the lake is without authorization of the Legislature. The several million gallons daily, now diverted, has no appreciable effect upon the lake; at the same time the volume is in excess of what has ever been regarded as within the private right of common use and a diversion of public water for sale for



private profit is not a right in an owner of riparian land which has gained recognition. Diversions of this sort will be followed in due time by claims of right, at once difficult to ignore but productive of still more confusion in our law of water if given recognition.

#### PRIVATE DIVERSIONS FROM THE GENESEE FOR OTHER THAN HYDRAULIC PURPOSES.

A number of cases of practically constant diversion through pipes exist within the Rochester city limits whereby private individuals or companies make use of the river water for private purposes in connection with manufacturing and in quantities far in excess of ordinary riparian use and without authorization by law.

#### POWER USES AT ROCHESTER.

At Rochester the physical situation led to private power development under a policy differing somewhat from that followed at most sites further up the river. The opportunities from a fall of 240 feet within two miles and at a commanding site for prospective trade attracted early settlers. A grist and sawmill was erected here in 1789 at the instance of the first private proprietors of the land, and before there was any legislation regulating stream uses. That mill was constructed by a white man who lived among the Senecas. He had no white neighbors for many miles, and he operated the mill for about five years when it was neglected and destroyed by floods. It was located on the edge of the mill yard tract, so called, of 12 x 24 miles, which Phelps and Gorham, the grantees of Massachusetts, had prevailed upon the Indians to cede to them at the time they acquired the lands adjoining the east side of the river. The failure of settlers to appear as soon as expected led to the abandonment of the mill. With the exception of a mill at Hartford, now Avon, no hydraulic mill existed in 1798 on the Genesee at the time of the passage of chapter 2 of August 10 of that year. The mill at Hartford was abandoned a few years later, so that there is no development on the Genesee to-day which is protected, under the clause of the act of 1798 in respect to mills constructed previous to legislation on the subject. The lower level of the river offered no opportunity

for power and did not need protection by the Legislature against dams. From the head of the upper fall to the foot of the lower fall the flow was sufficient but the channel was naturally impracticable for through boating. The act of 1798, therefore, defined the public right of way to be one "from the great fall until its junction with the Canaseraga creek." The first mill thereafter erected was with a wing dam, at a site now adjacent to Main street in Rochester on the west side of the channel. That form of dam did not necessarily obstruct through navigation. No personal privilege had up to that time been given for any dams on the Genesee. The first privilege of that kind to be given in the watershed was for a dam on the Canaseraga where the channel, in the boating season, was in constant use. The first mill in the shed, above navigation limits, was built in 1799 on Spring creek, at Caledonia, in the mill yard tract, according to Turner's history of the Phelps and Gorham purchase. Several wing dams were projected into the channel at Rochester soon after 1807, and at sites above "the great fall," and to the extent that they were saved from the penalties against obstructions by the act of 1798, they were legalized. None of them, however, was at a point where the channel was safe for boats, or where boats ever floated except as the result of accident. The likelihood of a revocation of the protective feature of the act of 1798 as to these mills was slight, and the likelihood of controversy with navigation interests so remote, that the builders were encouraged to project very substantial structures and to treat the act of 1798 as sufficient to justify the developments made. Nothing untoward having arisen down to 1817, when tranquillity prevailed after the war of 1812, and when the completion of the Erie canal was assured, great activity in hydraulic development arose at the village of Rochester. Dams extending from bank to bank were exempted from penalties under the Law of 1798, as well as wing dams, and in 1817 elaborate side races were constructed and wing dams at the site of the Johnson and Seymour dam extended, by joint action of the opposite owners, until they met in the center of the stream. Mills larger than ever were constructed along the races. As a terminal for river boats, the pond above the dam offered real advantages for navigation. The first dam at the crest of the

great fall was a wing dam constructed in 1807. Raceways on each side were projected there in 1818. In 1812, however, the first dam from bank to bank of the river was projected here to catch the whole low water flow at that fall. It was not until 1828 that mills were erected and dams built at the crest of the lower great fall, but in 1817 a development was made at the upper step of the latter fall and some fifty rods above. The channel below the upper great fall had never been declared a public highway and from that fall to the foot of the lower fall it was not actually boated because impracticable in its natural state. It was susceptible of improvement, whether feasible or not, which would make it practicable, as is every fall theoretically, and the public right to use or improve attached to that channel. Section 23 of chapter 47, Laws of 1813, above quoted, prevented any estoppel against the public in that respect. Privileges at all these points have been enjoyed under the protection of the statutes of 1798, 1801 and 1813 continuously ever since. About the year 1830 a privilege was exercised under the statute of 1813 at the flats between the two great falls where mills were maintained for some years, and an elaborate development planned, but it was abandoned a few years later and no power has since been used at that site. It cannot be said that these hydraulic developments at Rochester have ever actually interfered with any boats seeking to navigate the channel of the river because no boats ever sought to pass these sites. The construction of the first canal aqueduct across the river in 1821 brought the State into its first conflict here with riparian owners. But a more serious one, not disposed of until years afterward, arose in consequence of the construction and use of the dam, and connecting race in the river above, to supply the Erie canal with water from the Genesee. That diversion took the water outside the Genesee shed. The circumstances of that contest will be separately treated in another place.

The natural channel of the Genesee has never been canalized or otherwise improved except incidentally to the extent of the pond in the river at the feeder dam at Rochester. Except by the diversion above referred to, the natural flow between the site of the Johnson and Seymour dam at Court street just above the aqueduct, and the foot of the lower falls has never been dis-

turbed by the State save in the carrying of the Erie canal across the river by aqueduct. That structure, not being an improvement to Genesee river navigation, was properly followed by awards for damages so far as riparian owners were damaged. But private hydraulic structures have not up to this time been the occasion of any conflict with the State's right of control over the bed and flow of the stream for river navigation below the Court street dam. The State is now, however, about to canalize the river from Court street south to the Barge canal crossing. The security of those who, up to this time, have enjoyed power privileges arising either under the general clause of the acts of 1798, 1801 and 1813, or under special personal privileges carried by the numerous special laws enacted in the main prior to 1835 has been due to long postponement of river improvements. That postponement has resulted in the assumption that these privileges are really absolute and perpetual rights as against the State, and for some years the users have commonly called themselves power owners. This view has been facilitated by the fact that little has been known since 1850 of the terms of these statutes which, so far as the sites at Rochester were concerned, legalized during the pleasure of the State these dams and the diversion of the water. The acts of 1798, 1801 and 1813 have not been published as any part of our general statutes since 1813, and were omitted from all subsequent revisions because they were viewed as really local in their application. The term earliest used in the Genesee country to describe mill uses of the river was "privilege," and when applied at Rochester sites was, in the light of legislative provisions, accurate. The term "right" in describing the relation among users between whom these privileges had been subdivided was also accurate. At Rochester a gradual substitution of the term "right" for the term "privilege" as descriptive of the nature of the use of this stream for private hydraulic purposes has taken place.

#### RACE COMMISSIONERS AT ROCHESTER.

Division of the water of three power races, two leading from one dam and one from another, is made by gate regulation, by race commissioners, so-called, who hold formal appointments from the Supreme Court. The occasion for these appointments was, in

the beginning, a state of dissension among a multiplicity of users of water from the races of the two upper ponds, users believing during low water, that other users were getting more than their share. Following upon the early subdivision of race rights by deed, arose complications which furnished occasion for legal proceedings. These were suits in equity to have the shares in the races as between the parties declared and to have the court at the same time appoint men to operate the race gates. Such commissioners were appointed to have charge of the gates in Brown's race in the year 1854 and for the east race coming from the upper pond in the year 1856 and for the west race in 1881. As these men have died or resigned, successors have been appointed by the court. These commissioners have operated the race gates according to the rights of the users as between themselves, as defined in the decrees, but they also regulate the diversion of the water from the river into the races. Since the courts could not be the source of authority for diversion of the water from the river, the commissioners are the agents of the parties who united in employing them to divert the water. If diversion of the river water into the races by these private users is based upon a right which is perpetual and absolute as against the State itself, then, since the diversion is practiced for the exclusive and private advantage of the users, the right is in all respects a species of private property. If so, then it is the only species of private property devoted to private use over which the judicial branch of the State government ever exercised a permanent administration, for there is no parallel for such jurisdiction in respect to other forms of private property. Careful research fails to reveal any decision, where the question was litigated, which holds that any court possesses any such jurisdiction in respect to hydraulic uses. No legislation has ever authorized that use of judicial power. In the suits in which these commissioners have been appointed, all parties united to ask the court to make these appointments, so that these decrees do not constitute a judicial determination that the court possessed this jurisdiction. Regulation of the gates by race commissioners for over fifty years, under Supreme Court decrees, has appeared to confirm the claim made by the owners of the adjacent riparian land, that their rights in the hydraulic uses of the river are inherent and absolute.

## TRANSFERS OF ROCHESTER PRIVILEGES.

At Rochester shares in river race flow are now bought, sold and mortgaged under the name of rights, and conveyances are made accompanied by covenants of title like those common to conveyances of upland, and bonds are issued by corporations which have pledged, with other property, these privileges, and they have been valued in capitalizing private corporations as if perpetuities as against the State. A single private corporation has taken by deed shares representing upward of 90 per cent. of the power covered by outstanding privileges at Rochester. When the municipality in the year 1873 needed hydraulic power, for use at a pumping station and water for fire protection, the city authorities did not apply to the Legislature for a privilege to use river water, but paid a considerable sum to private individuals and took their deeds of shares in the races from the two upper ponds.

## TAXATION OF WATER POWER AT ROCHESTER.

Anomalies, by way of assessments, have arisen at Rochester, resulting from attempts to tax power uses as perpetual private property rights. This originated in 1858 and followed closely upon the first appointment of race commissioners. It appears from the rolls that the city assessors have noted, in connection with the assessment of mill property, described in the usual form of assessment, "runs" and in certain cases runs with no accompanying assessment of land. In the first case a valuation in a single lump sum, covering both the mill property and the runs, is made. Beginning in 1871 the term "right" has been used in the rolls in place of the word "runs." This change followed a change of description used in later decrees fixing race shares between users. No legislation in this State has ever authorized taxation of water power in addition to, or in connection with, but as a species of private property distinct from land, whether the power is derived either from public waters or from private waters. Our general tax law has always required that lands be described so as to be capable of location and identification on the face of the assessment-roll, and without regard to particular rights of use to which it may be subject and that the assessment be made against the name of the general owner or actual occu-

pant. The valuation is to express, in one sum, all use values of the land described. The practice of Rochester assessors in assessing water power as a special use in or as something separable from real estate was not, as far as learned, a duty imposed by any judicial decision. No instance is known of any attempt to enforce payment of a tax based upon one of these water power assessments, but it would appear plain that such an attempt would be unsuccessful because an assessment, in the form practiced, is without warrant of statute. There is of course no power used at any of these mills that does not depend upon a utilization of the river bed and submerged riparian land for pondage, the dams and races, but these assessments in no case, nor in all cases together, cover the land thus necessary to create and for utilizing the power. If these assessments were illegal, payment of the taxes has of course been voluntary. The fact that the taxes have been paid for years has been treated as corroborative of the claim of perpetual private right in the persons assessed, to divert and use the river water for their exclusive benefit. If, however, use of power from these public waters results from a privilege, the privilege rests on a franchise, and in that case it is not an inherent right in the riparian owner. Such franchise, moreover, not being clearly covered by the terms of the present franchise tax law, wholly escapes taxation, and water power of the Genesee at Rochester wholly escapes enforceable taxation.

#### DAINGEROUS CHANNEL ENCROACHMENTS AT ROCHESTER.

Storage of flood waters by the State to regulate stream flow on the Genesee would further involve the State in the conditions now existing in the channel at Rochester, affecting its carrying capacity. Effects of sudden floods up the valley are minimized at Rochester by the extensive flats on the river above, but the natural channel at Rochester has been reduced at the vital point of Main street bridge in the city's heart. The discharge capacity of the arches of the Main street city bridge is 383 square feet less than the discharge capacity of the State aqueduct arches a little higher up stream, and at Main street bridge the channel is but half its original width. At Rochester, the river has been subject to a flood flow of 40,000 cubic feet per second. While the completion

of the Barge canal will make it possible for the State to eliminate the Rochester aqueduct, there may be local reasons why it should be retained for other uses. When it may be abandoned for canal use, the State may be relieved of any legal responsibility to arise from the presence of this structure in the channel. While regulation of stream flow will reduce the volume of flood flow at Rochester, insurance against the unexpected by a restoration of normal channel capacity at this point should be provided. Invasion of the channel for other than hydraulic purposes at this point has been extensive. The municipality itself is responsible for a bridge of inadequate length at Main street. Private riparian owners have plotted and deeded the bed of the river immediately above and below this bridge where it is occupied with masonry foundations of buildings in which business of various kinds unrelated to water uses is conducted. Here is the only instance in this State where, at a point where flood injury would be so great, the serious obstruction presented by the Main street bridge is intensified by private buildings adjacent to both sides of the bridge, of considerable depth, and which reach from one side of the contracted channel to the other. The consequences of this situation were demonstrated in a flood in the year 1865, when the river broke its banks above and carved temporary channels for itself through the streets which parallel the river, and great destruction of property followed. A previous flood tore off wooden buildings which lined this bridge and carried them down stream. The Legislature was appealed to by the flood sufferers to permit claims to be filed to hold the State responsible in damages. The Legislature refused, and many reasons existed to justify the refusal. Under existing statutes, sufferers, in case of another flood, would have the right to present claims against the State and have them heard. The failure of the Legislature to provide adequate supervision over stream invasion has been particularly serious in its consequences at Rochester. The Legislature did, by Laws of 1866, chapter 639, impose on the common council of Rochester the duty of bringing injunction suits to prevent channel encroachments within the city which would interfere with the flow of the stream. The remedy left a duty, naturally executive, to a body of another character. The remedy, such as it was, was applied with



much caution, and suits, which ended unsuccessfully in the lower courts, were not pressed to the highest. Under this statute, the question was litigated with seriousness as to whether stone piers in the middle of the channel would or would not interfere with stream flow and on one trial it was held that they would not. Encroachments were then pushed more boldly and the existing channel situation is the result. Within quite recent years new buildings have increased the extent to which structures cover up the river. None of these private structures has been planned or erected under any public supervision. In the revision of the city charter, in the year 1907, such power as existed in the common council through the injunction remedy to prevent encroachments was repealed. To-day there is neither supervision nor administrative power of supervision, State or local. The provision of the conservation law to secure the safety of dams would be inadequate for dealing with this situation at Rochester for it is complicated with other types of structures. The less secure the dams at Rochester, the safer is the city. After the flood of 1865 the Legislature inquired, through a commission, into the causes. The commission reported, recommending that safety gates be inserted in the Court street as well as in the Central avenue dam and that all further encroachments be absolutely prohibited. (Assem. Docs., 1866, No. 117.) Practically nothing has been done as the result of these recommendations. The situation has been mitigated in certain directions while it has been aggravated in others. The power users, whose dams are a factor in the dangerous situation which exists, leave the matter of public safety to be attended to by the public. The principal measure so far taken to give protection, has been to raise the west river bank above Court street as a municipal work and to assess the expense on properties benefited which were in fact largely owned by persons who had done nothing to contribute to the situation which caused the danger. During the present year, by a contract, let by the municipal board of contract and supply, in the name of the city, the hydraulic dam previously existing at Central avenue was removed and a new concrete dam substituted. Careful search fails to discover any power running to the municipality for the building of a dam in the Genesee river. The occasion for that

work arose out of the building of a new municipal bridge in place of an old one upon which the old private dam had rested for support, and there is some understanding between the municipal officials and the parties using power diverted by that dam, for offsetting the cost of constructing the dam against the value of certain lands owned by some of the power users and to be taken in widening Central avenue. Experience would indicate that any reclamation of the river bed against the encroachments which have occurred at Rochester and any adequate future supervision of the river, requires intervention of an appropriate State department clothed with adequate authority. Whether the river flow is to be regulated or not, to deal with the situation at Rochester, which involves the safety of a large community, comes within the natural range of conservation work.

#### BARGE CANAL HARBOR.

The Barge canal improvement will result in canalization of the Genesee from the point where the canal will cross the river in a pool at Genesee Valley park, Rochester, to a point below near Court street. There the harbor will end at a dam to be constructed by the State. Conservation of flood flow of the Genesee would here become involved with the canal system. This canal work within the river will, however, constitute a navigation improvement of the natural channel of a navigable stream and along a section thereof which has always been navigable and long navigated. Such an improvement may be made without compensation to private holders of title to the bed. Only private upland, necessary for flooding, must be purchased. The power incidentally created at the harbor dam will be subject to use or disposition by the State, for, as against owners of riparian lands below the dam, the State will be bound only to deliver the natural flow, to the stream bed at the foot of the dam, that is, not under a head. The State is already owner of a long strip of upland adjoining the east side of the river where this pondage will occur, acquired for construction of the Erie canal and its feeder. Along that reach the State, under the decisions, holds title to the river bed to the center of the stream. Certain small parcels have been declared abandoned and conveyed by the State, but title to parts

of the bed of the river under the pond above the Johnson and Seymour dam is in the State as riparian owner. This riparian strip is now occupied by the tracks of the Lehigh Valley Railroad Company under a revocable permit granted by the Superintendent of Public Works in 1888 to the Rochester and Honeoye Falls Railroad Company. That permit recites the payment to the State of the sum of \$2,500, fixed as the value of the privilege by appraisers appointed by the Supreme Court, but no statute is found under which that proceeding was authorized.

The State owns considerable land at the site of the Rochester weighlock which will be available for utilization of all the power from the harbor dam and where a very effective head will be obtainable through use of the old Erie canal channel as a tail race when that channel may be abandoned for navigation purposes.

#### RECLAMATION OF RIVER BED.

Extensive invasions of the river bed have been made through the filling in of the channel by riparian owners. This is now in progress at points along the east side of the channel, above the weighlock, and has been practiced for a long time along the west side of the channel southerly from Court street. Between Court street and Main street the natural west channel of the river, which created an island, was utilized as the origin of the Carroll and Fitzhugh race. Between Andrews street and the crest of the main fall a natural channel on the west side which formed two islands was taken for the original construction or extension of Brown's race. That the crest of this fall was naturally about twice its present extent is discernible to-day by a glance at the exposed rock face. Railroad bridges and electric conduits are carried across the channel without express privilege and with no public supervision of the work.

#### STATE'S RIGHTS OF DIVERSION FROM THE GENESEE.

The Erie canal was completed, proceeding westward, as far as the village of Rochester in the year 1822. At that time there was constructed as part of the very durable appurtenances, a dam across the river at the rapids about two miles above the village and a navigable raceway from the east end of the dam northerly

following the east bank of the river to the Erie canal. Until that canal was continued to some other source of supply, the Genesee was the only means for filling the western level. The canal was completed to the Niagara river in 1825 and since that time Lake Erie water has been largely depended on. It has been shown when the question has been up since, that it was both necessary and intended, at the time of original construction that the Genesee should be permanently relied upon as a feeder. What quantity of water was to be taken and at what times, from the Genesee at Rochester, has been settled in the disposition of damage claims since 1822. In the year 1826 claims for damages on the part of some fifteen different persons owning riparian land along the river below the point of this feeder diversion and at sites where power from the river was used or available, were presented to the canal appraisers on account of the construction of the Erie canal. These claims were disposed of on a brief record common under the practice and statutes of that time. Money damages were awarded and benefits to some extent, as the statutes then permitted, offset against injuries, and the awards concluded the parties. (For record of claims and of sites owned by claimants see Assembly Docs., 1854, Vol. 2, No. 63, Ex. 2.) Claims for additional damages for diversion for the Erie canal at Rochester were heard by the canal appraisers in 1855 (Senate Docs., 1856, Vol. 3, No. 103), and at the same time the same claimants were heard on account of diversion of water to feed the Genesee Valley canal which had in the meantime been constructed. It was agreed between the parties that the appraisers should determine whether these diversions had been under a temporary or under a permanent original appropriation of a diversion right. Upon that point the appraisers determined that the original appropriations were of permanent rights; that the persons injured were those who owned the lands affected at the time thereof; that such owners, so far as they had previously presented claims, had been paid or concluded by set-off of benefits and, so far as they had failed to present claims, their claims were outlawed and that their grantees of the mill sites, then making claim for these damages, were not entitled to recover because they were not the ones injured by the original taking of the right of permanent diversion. The

awards thereupon made in accordance with those views were reported to the canal board which, on January 6, 1857, duly confirmed them. (Senate Docs., 1857, Vol. 1, No. 12.) The awards were finally confirmed by chapter 617, Laws of 1857, and, as far as money damages were awarded, were paid.

Since that time Rochester power users have sought to obtain regulation of the Genesee at State expense on the claim that it was equitably due to them as compensation for diversion rights taken from their ancestors or grantors without compensation. (Senate Docs., 1894, No. 46.)

It may be true that in 1826 a few owners of riparian land at the village of Rochester, who did not present claims for river diversion, were entitled to damages, but it does not follow that such failure to present claims was unintentional. The Erie canal project was one which appealed to the people of that day. Much of the right of way was donated to the State, partly by express grant of whatever lands the State should see fit to take, and partly as the result of the unwillingness of landowners to file claims for damages. Failure of Rochester landowners to file claims in 1826 or acquiescence on their part in smaller awards than may have measured the full extent of their legal rights, does not show that they misunderstood the effect of action which was in general accord with the attitude of the people of other localities in respect to damages on account of the canal. In disposing of these Rochester claims, in 1855, the canal appraisers at the same time heard and made awards for diversion rights to supply the Genesee Valley canal. The appraisers held that the State, by similar original appropriation, acquired perpetual right to divert from the river so much water as might be necessary for that canal, and, upon testimony submitted, found that the average amount of diversion during low water, which occurred during navigation season, for that canal was 3,600 cubic feet per minute. On proof in addition of the value of water power at Rochester the appraisers estimated the damages which the claimants had suffered by the permanent appropriation and determined upon a gross sum to represent the value of the perpetual right and made awards accordingly. Upon the same basis the right originally acquired for the Erie canal would be one to divert the amount ordinarily

diverted for that purpose after the original appropriation. For about three years after 1822 the Rochester level of the Erie was supplied exclusively from the Genesee and practically the whole of the low water flow of the river consumed for that purpose. Through subsequent extensions of the Erie to Niagara and subsequent enlargements the State, at its own expense, of course, has supplied itself with such a flow from Lake Erie, available for the Rochester level, that it is many years since the Genesee has been relied upon or used, although a temporary draft in the year 1879 is recorded. (Assem. Docs., 1880, Vol. 8, No. 137.) The State's rights, however, to divert have not legally abated in favor of power users at Rochester by the State's subsequent acquisition of other supplies. Permanent appropriation by the State of a perpetual right in property necessary to the canals and paid for or an opportunity of payment offered, remains good in case of non-user. If, under existing conditions, the Genesee is no longer necessary as a source of supply to the Erie canal, the State may use its rights in any beneficial way it sees fit. The State could not, however, divert this water in a volume in excess of what it would be entitled to use for the Erie canal or at a different time of year. Observing these limitations, the State may utilize this amount of river flow as against all riparian owners at Rochester. Opportunities to do this beneficially to the State will arise at sites to be created in carrying the Barge canal across the Irondequoit creek valley.

Use of the Genesee Valley canal ceased in 1877. It was abandoned formally in 1880, when express provision was made to retain the diversion rights previously used for that canal, for future needs of the Erie. (Chap. 326, Laws 1880.) By chapter 166, Laws of 1882, the State released to owners of lands adjoining the Dansville branch full rights in the water privileges and lands taken by the State at the time of construction, on condition that they release the State from any duty to maintain this branch and its structures, and numerous landowners availed themselves of the opportunity offered. If the Erie, because of adequate feed from Lake Erie, shall not need the supply acquired for the Genesee Valley, the State may use that water beneficially as suggested, in the case of waters originally acquired for the Erie canal.

The State has another right, the result, no doubt unintended, of taking certain land adjoining the west bank of the Genesee river for locating the new aqueduct constructed over the river for the Erie canal in 1840. These lands were available for mills and with ownership, as between lot owners, went certain rights to share in the power of the west side race from the Johnson and Seymour dam. When claims were presented for the taking of these lots the canal appraisers determined, on a retrial ordered by chapter 220, Laws of 1841, that the State must pay for the land, and with its value was included the value of water for twenty-eight shares in the race, and awards made accordingly which were paid. The water involved was not available at that point for canal purposes, and the State did not see fit to use or dispose of it otherwise, beneficially, so the water continued to run as before. The owners of mills using from that race, in an attempt to extinguish the twenty-eight shares which the State had paid for, by a suit between themselves, procured the Court of Chancery to redivide by decree the whole flow of the race between them. In 1855, in disposing of the claims first referred to, the canal appraisers held that such a proceeding was entirely ineffectual as against the State and, in disposing of the claims for diversion for the Genesee Valley canal filed by users from this race, held that the State as against them was, to the volume of water covered by those shares, using its own property. (Sen. Docs., 1856, Vol. 3, No. 103, p. 57.)

Excepting diversions for short periods, since 1879 the State has not used beneficially to the public any part of the Genesee river flow. To the extent of the State's share of that flow the State has gratuitously bestowed power upon the proprietors of hydraulic establishments at Rochester. This policy on the State's part was not unintentional for, in response to repeated representations by Rochester interests as to their equities as against other localities where the waste might have been used at a profit to the State, the canal officials refrained from making leases for the use of this wastage at points away from Rochester. At the same time the private beneficiaries of this policy at Rochester were not required to pay for the power which as a result they obtained. The same proprietors have enjoyed additions to the

Genesee river flow arising from storage in the Rockville and Cuba reservoirs acquired for the Genesee Valley canal. The State still owns and maintains these reservoirs. The state's diverting devices at Rochester are now and have been for some years past out of repair and ineffective, and the conduits from these reservoirs to the Genesee channel are not now in a serviceable condition. The flow from these reservoirs when unobstructed, the Cuba reservoir being outside the natural shed of the Genesee, is additional to the natural low water flow of that river. These reservoirs, designed to afford a combined feed of 66 second feet during the summer months for the Genesee Valley canal, are wholly within the State's right of control as against owners of Rochester mill sites. The same is true of the flow impounded by the feeder dam at Scottsville on Oatka creek, and that flow may be diverted into the Erie canal via the prism of the abandoned Genesee Valley canal reserved by the State for that purpose, and a pipe conduit since constructed, beneath the Genesee at Rochester leading into the Erie canal feeder. The reservation of these reservoirs and connecting feeders was provided for when the banks and prism of the Genesee Valley canal were sold in the year 1880, to the Genesee Valley Canal Railroad Company, and that company obligated itself to maintain in perpetuity the reserved channels free from obstruction.

An overflow has been permitted to continue from the Erie canal into the Genesee river for many years, through the unused Erie canal feeder through the State's races at the weighlock and in very substantial leakages of long standing from the canal into city sewers. The volume of this overflow has never been measured.

The average volume of water diverted from the Genesee river for the years 1823, 1824 and 1825 and subsequently, as reported to the canal board in 1848, was 52 second feet. (Assem Docs., 1848, Vol. 5, No. 172, p. 5.) No lease of surplus canal waters affecting the Genesee Valley canal or the Rochester level of the Erie has ever been made by the State.



TABLE J.

TABULATION OF STATE RIGHTS TO DIVERT WATER FROM ROCHESTER MILL SITES.\*

Water subject to diversion	Basis of right	Average volume in second feet	When divertible
Natural flow of Genesee River.	Appropriation in 1822 for Erie canal.	52	Through season of canal navigation.
"	Appropriation in 1840 for Genesee Valley Canal	60	"
Cuba reservoir storage flow.	"	48	Any period of whole year.
Rockville reservoir storage flow.	"	18	During season of canal navigation.
Wastage from Erie canal drawn from other sheds.	Appropriation in 1822 and later for Erie canal.	Unknown.	Throughout whole year.

\* Exclusive of state's Carroll and Fitzhugh Race Rights.

## EARLY LAKE STORAGE.

When in 1822, the Erie canal depended entirely on the Genesee for its western level, the Canal Commissioners constructed storage dams at the outlets of Lakes Honeoye, Canadice, Hemlock and Conesus. This storage was drawn upon until a substitute supply from Lake Erie was secured in 1825. After that year this storage was no longer drawn upon. Private users of power along the outlets of these lakes then kept up and made use of the storage for their own benefit, provoking the riparian owners about the lakes to such an extent that three of the dams were wrecked. The fourth was destroyed by a storm. No releases of the storage rights in these lakes thus appropriated by the State are found. No map appears to show these lakes as canal properties. No record of awards for flowage rights are found and, since the only original records made during the first few years following the construction of the Erie canal were the award books of the canal appraisers, destroyed in the Capitol fire of last years, the facts as to awards may never be ascertainable.

## MOUNT MORRIS.

At this point the original power development was private and based upon chapter 181 of the Laws of 1826, whereby Wm. A. Mills and his associates were authorized to dam the river between the towns of Mount Morris and Leicester to the height of fourteen feet at ground owned or purchased by them, on condition that a lock 18 x 100 feet should be inserted in the dam and

maintained for the free passage of boats during the navigation season on the river. The privilege was without prejudice to the State in taking water of the river for the use of any canals thereafter constructed, or of using the water in the dam for all navigable purposes without remuneration to the owners of the dam. Penalties, recoverable by boatmen who might be detained on account of the dam, were provided and it was expressly recited that the act might be repealed at any time. The act was amended in 1827 and a dam fifteen feet high and a navigable raceway with an appropriate boat lock in place of a lock in the dam, were permitted. By supplemental act, chapter 142, Laws of 1829, bonded security to meet penalties for interference with navigation was provided for, and all privileges were to be forfeited on failure to file the bond. No bond having been filed up to 1837 and within the time limited, the default was excused by chapter 211, Laws of 1837, and the privileges made conditional upon a renewal of the bond every three years. This bond has not been renewed to date as required. Prior to the construction of the Genesee Valley canal, contemplated in 1829, the dam had been constructed and this navigable raceway connected therewith. The raceway led from the pond raised by the dam northeasterly about two miles where it united with the Canaseraga creek. Until the Genesee Valley canal was completed the race was available as a free public canal for through boating on the river. From the race was drawn the water used at Mount Morris for hydraulic purposes, taken from the whole flow of the river. No diversion to the west side of the river here has ever been authorized.

The construction of the Genesee Valley canal at this point was begun in 1839. It was at first planned to carry the canal across the Genesee in an aqueduct close above this dam, and to facilitate construction of the aqueduct the dam was partially destroyed by the canal commissioners. The Legislature then determined that the canal should cross the river at this point in a pool. The State thereupon reconstructed the dam and mapped and threw its blue line around the pond, taking in the whole site of the dam, the guard locks into and out of the river, the towpath bridge across the river, half of the lock into the race, and riparian land between the lower and upper blue lines across the river. In a claim filed

by Mary Murray et al., claiming under those who had constructed the dam, and heard before the canal appraisers on July 28, 1843, it was expressly held that the State had appropriated, for the Genesee Valley canal, the whole of the dam, its site and the river pond. The canal appraisers held that all right to damages for the appropriation of the dam rested on the fact of its legality, under the privilege granted by the act of 1826, but that since, and by reason of the State's appropriation of the pool for canal use, the claimants would be relieved of its maintenance and be benefited, the benefit was set off against damages. The appraisers made an award for money damages for the detention of the mills located on the race, on the ground that the act of 1826 still being in force, claimants were entitled to the use of surplus water, and to damages for certain land taken, and an award in the sum of \$2,901.97 was made. An appeal by claimants to the canal board was thereupon taken, which was heard and decided on July 5, 1845. This award was affirmed and paid on October 29, 1845. In the meantime these same claimants had been held liable to boatmen who were detained at the dam in navigating the river. Chapter 229, of the Laws of 1844, made an appropriation to reimburse these claimants the amount of such recoveries on the ground that the detentions were the result of the State's act in destroying the dam. The claimants subsequently suffered other recoveries on the same ground and were reimbursed by the State by chapter 160, Laws of 1845, which recites that the appropriation shall be in full on account of all claims of claimants arising out of the appropriation of the dam by the State. The State has never since that time by lease of surplus canal water or otherwise, granted that site nor the dam, nor its rights in the waters impounded thereby. After the abandonment of the Genesee Valley canal, in the year 1880, the sale of it was authorized and such a sale was made to the Genesee Valley Canal Railroad Company, but that grant conveyed only the banks and the prism. Since this dam and the bed of the river formed no part of the banks or the prism of the canal they did not pass by that grant. The railroad which was subsequently constructed on the banks was carried over the river on a bridge. The dam, the pond and the river bed were never used in any way by the railroad cor-

poration taking the grant. In the year 1892, the then existing dam went out in a heavy flood. A private corporation known as the Mount Morris Water Power Company, organized under the business corporations law in 1902, now owns, subject to the public right of user for navigation provided for in 1827, the old raceway still existing at Mount Morris. The raceway has not been maintained in a condition for navigation. In connection with ownership of the raceway this company claims to own the pond in the river and the existing dam, and continues to divert water through the race but for power purposes only. It appears from the records in the Livingston county clerk's office that this company has taken a conveyance of any rights of those who made claim to the privilege arising under the act of 1826; also a release of the pond and dam, executed by the Western New York and Pennsylvania Railroad Company, the successor of the Genesee Valley Canal Railroad Company. On the strength of this title to the water power, the Mount Morris Water Power Company, about the year 1902, rebuilt the dam on substantially the same site and within the blue line surrounding the old dam. That company has since executed a mortgage on the dam and its site together with the raceway and other property including any outstanding privilege existing under the act of 1826. After the dam went out in 1892 the Legislature, by chapter 316, Laws of 1897, gave to the town of Mount Morris, for the declared purpose of supplying water for sanitary and other uses, authority to construct and maintain a dam at, or near, the old site not to exceed the height of the former dam by more than two feet, and to bond itself for the purpose, not exceeding \$30,000, with power to take and acquire rights to the use of water for the purposes aforesaid, or otherwise vested in any person, association, co-partnership or corporation, or sell and convey any and all rights granted under the act. The town never took action under this authority either to sell the privilege granted to it or to purchase any outstanding privileges. This act has never been amended or repealed.

The Mount Morris Water Power Company which built and uses the new dam is itself performing no public service nor is it required so to do by law.

Unlike the case at Rochester, in respect to taxation of power

privileges, there is no attempt at Mount Morris to tax them as something separate from land, by any description whatsoever, but the dam, pond and raceways by which the power now used there is developed are not taxed at all because not carried on the assessment-rolls. The only real estate which is assessed to the Mount Morris Water Company is a one and one-half acre parcel of land described as located on the flats, and assessed at a value of \$150. If the use of hydraulic power at this place is based upon a perpetual private property right, its value, whatever it may be, wholly escapes taxation. If the use is based upon a privilege, it also escapes taxation as a franchise. If the privilege granted by the act of 1826 and the supplemental acts survived the death of the original beneficiaries, then, although the privilege is alive, the conditions attached have not been observed in that the raceway has not, since 1840, been kept open for navigation. The raceway has never been relieved of that servitude by subsequent legislation nor has the obligation to file new bonds been released. The purpose of chapter 316, Laws of 1897, granting a privilege to the municipality, so far as it sought to secure reconstruction of the dam, has been met. There seems to be then no reason why the act should remain a law. The interests of the State would be best served by its repeal.

#### THE RIVER GORGE.

The gorge, extending from Mount Morris to Portage Falls, covers about eighteen miles of channel and contains sites available for power developments, and some were used in the days of early settlers. The sites of five of the special privileges on the Genesee were within the gorge, but the dams were maintained only a few years for saw mills and disappeared, probably with the merchantable timber supply. A privilege previously referred to and extended to the Mount Morris Water Power Company by chapter 564, Laws of 1903, authorized a dam thirty-five feet in height at some site in the gorge to be selected by that company, but it has not been acted on during the eight years which have since elapsed. In view of the fact that the privilege was given for a purely private purpose to a private company and with no consideration to the public, there seems to be no reason to doubt that it is subject to repeal at the will of the Legislature,

without liability of the State to make compensation. The privilege extended in this case, as in any case where a dam is to be thrown entirely across a public channel to develop power from impounded water, authorizes an exclusive occupation of the channel and an exclusive privilege is acquired for the exclusiveness is not dependent upon any legislative declaration so characterizing the privilege. The prohibition of the State Constitution, effective January 1, 1875 (Art. III, § 18), which prohibits the passing of a private or local bill granting to any private corporation any exclusive privilege or franchise whatever, applies undoubtedly and invalidates chapter 564 of the Laws of 1903. The outstanding privileges granted before 1875, not being in aid of any public use or founded in contract, would be necessarily repealable. The State may resume all public rights in the river within the gorge by a repeal of all outstanding privileges and without incurring any liability for damages. The regulation of the stream flow by storage and utilization of the resultant power at any point within the gorge would require that private riparian land within new flow lines or areas required for structures, be purchased. As the privilege granted to the Mount Morris Water Power Company by chapter 564, Laws of 1903, has not been exercised within the eight years which have since elapsed, there seems no good reason why that act should not be repealed, whether regarded as an unconstitutional grant or otherwise.

#### LETCHWORTH PARK.

At this site occurs the Portage falls where, within a distance of about two miles, the river drops 362 feet. Except a small power obtained at the Portageville rapid, close above the upper fall, there is no existing development here. A privilege was given in 1828 for a dam below the large fall, but it was long since abandoned. The Portageville development is based upon chapter 155, Laws of 1826, which reserved the right of repeal and the right to use the river for the benefit of internal improvements or navigation, in which case it shall not be lawful for the beneficiaries or any person owning the dam to claim or recover any damages. This site as well as sites in the town of Hume, Allegany county, for which privileges were granted at the same time

and with the same proviso, fall within the site widely favored for a storage pond for regulating the flow of the Genesee. The only other privilege, ever granted, affecting the Portage Falls site was that given the Genesee River Company, in connection with its special charter, by chapter 605, Laws of 1898, and amendments thereto. That company, not having complied with the time limitation imposed by that legislation, was, by proceedings taken in 1911 by the Attorney-General, dissolved by judgment of the Supreme Court. The judgment, in which the company acquiesced, declared forfeited all rights granted by that legislation. The land bordering this site of wonderful power possibilities, at an early date attracted men interested in water power at Rochester, who purchased and plotted the riparian land but, as the site never became a center of settlement, no extensive power development was ever undertaken. This site has now come into full possession of the State through the gift of the late William Pryor Letchworth by deed dated December 31, 1906. The new value of this site, arising from the possibility of power transmission, is now an asset of the State at large because no development can, on account of the State's riparian ownership, take place except made by the State itself or with its consent. The State's title to the riparian land extends from the rapids above the upper fall to the foot of the lower fall and no diversion of the flow between these limits can be made except as the State consents. The width of this riparian holding is so ample as to eliminate all private interest in the natural bed of the stream between the upper and lower extremes of the State's holding.

There is, however, a condition attached to the gift which reads as follows:

"This conveyance is made upon the condition that the lands herein conveyed shall be forever dedicated to the purpose of a public park or reservation, subject only to the life, use and tenancy of the said William Pryor Letchworth, which are hereby reserved by him and he shall have the right to make changes and improvements thereon.

"To have and to hold the above granted, bargained and described premises unto the said party of the second part forever, subject to the conditions aforesaid."

Mr. Letchworth having recently died, the State's right of possession under the deed is now complete.

This gift was accepted by the State pursuant to the authority of chapter 1, Laws of 1907, which contains the following provision:

"Title to such lands is accepted upon the terms and conditions stated in said deed, namely, that the land therein conveyed shall be forever dedicated to the purpose of a public park or reservation."

The act further provided as follows:

"All lands described in and covered by said deed of William Pryor Letchworth shall be deemed to be in the actual possession of the Comptroller of this State, subject to such life use and tenancy of said grantor. After the death of the grantor the American Scenic and Historic Preservation Society shall have control and jurisdiction thereof for the purposes stated, unless the Supreme Court shall determine otherwise for good cause shown upon application of the Comptroller or some other duly authorized official of the State."

The provisions in reference to possession in behalf of the State by the Comptroller and to control by the American Scenic and Historic Preservation Society, so far as they would interfere with the use of riparian land for pondage and stream regulation, would be subject to modification by the Legislature. The condition of the grant in requiring that the lands shall be forever used for the purpose of a public park or reservation confronts any project to divert the flow from any part of the channel for power purposes or to locate a storage dam and create pondage within the park. It is contended on the one hand that storage or power development would be inconsistent with the purposes of a public park or reservation and if not within the letter, within the spirit of Mr. Letchworth's proviso, and, on the other hand, that the scenic beauty of the gorge would, by proper regulation of river flow, be enhanced. Representatives of the American Scenic and Historic Preservation Society are on record as opposing any



such undertaking to affect the park, taking the ground that it is desirable, if not required by the spirit of the limitation on the gift, that the wild beauty of the park should be undisturbed. A question involving the purpose of a private donor can only be disposed of by a judicial construction of the deed, and until that is done it would seem inadvisable that any such improvement be undertaken by the State. If the question shall be presented for adjudication, it can be shown that, at the time this restriction on the gift was imposed, there had for a long time been pending a project for the location of a dam at a point now within the park on each side of the river, as an enterprise of private capital under the privilege granted to the Genesee River Company and under which neither public control was reserved nor advantage assured to the State at large. That project met with widespread opposition in which Mr. Letchworth shared. It may, therefore, be urged that it would neither be contrary to the letter or spirit of the condition to regulate the river and develop power as a public project under restrictions insuring State control and State-wide benefit and along all lines of water conservation. The determination of the question might be secured on submission by the Conservation Commission and the American Scenic Society or other interested parties, of the matter to the courts. The State has a right of diversion of river flow around Portage falls which is wholly independent of the deed of Letchworth park, and the right extends to the volume formerly diverted for the Genesee Valley canal.

#### LANDS GIVING RISE TO DAMAGE CLAIMS FROM RIVER REGULATION.

The natural opportunity for storage pondage on the Genesee are only two: one in the valley above beginning at the head of Portage falls, and the other in the river gorge immediately below. At either site the land to be submerged is almost exclusively held in private hands and would have to be purchased or condemned. With the exception of the channel through Letchworth park, the riparian land on both sides of the stream below Portage falls is in the main in private hands. The regulation of stream flow along these private lands would constitute an invasion of the strict

right of the private riparian owner to have the flow take its natural habit and volume. That riparian lands subject to flooding would in fact be so far benefited by regulation of flow that the legal right to damages in case of regulation would be nominal and not worth seeking. Where regulation is not a positive benefit to riparian land the damages to arise from mere regulation would also be nominal. No municipal lands may be the occasion for payment of damages of this character except as the Legislature otherwise provides. The only municipal holding of any extent is the Genesee valley park at Rochester. The riparian land belonging to the State of any amount outside the Letchworth park is the State's farm at Industry and the canal feeder lands along the east bank of the river at Rochester. Damages depending on the question of private right to divert for power uses would not result from mere regulation of stream flow but may arise from the position which the State may take in respect to permitting the stream flow to be diverted, before or after regulation, for such uses without compensation to the State.

#### LANDS TO BE BENEFITED.

The extent of the flat lands to be beneficially affected by regulation of river flow from storage above Portage is set forth in detail in the surveys and reports of the State Water Supply Commission. These surveys also show the falls, from Portage to the Lake Ontario level, where available mill sites occur which would be increased in value by stream regulation. Since the time when the subject of these benefits has been under consideration, the city of Rochester has entered upon a sewage disposal improvement whereby the sewage will be eliminated from the river channel and the former interest of that municipality to have the channel flushed by flood storage does not now exist.

#### THE STORAGE PROJECT.

The sweeping powers and absence of burdensome conditions accompanying the charter and privileges granted to the Genesee River Company in 1898 in the expectation of securing regulation of the Genesee, and the subsequent failure of that company to undertake the project, indicates that it must be accomplished, if at all,

as a governmental enterprise. This may be accounted for by an unwillingness of private capital to encounter the uncertain range of damages both from dam failures and from regulation of flow in case of a channel where riparian land is divided into numerous small private holdings, all largely under expensive improvements of various sorts. The Barge canal crossing of the river, as part of a State undertaking authorized after the chartering of the Genesee River Company, creates a new situation which alone might justify refusal of another private charter under which regulation of this river by private interests would be complicated with the physical control by the State of its canal waters.

Rochester presents the chief problem of damages and benefits to arise from regulation because of its power possibilities, river front development and channel congestion. Before the range of damages and benefits to arise there from river regulation can be properly considered the volume of regulated flow to be permitted to pass through that city must be known. The determination of the latter question is closely related to, if not dependent upon, the disposition to be made by the State of the surplus Barge canal water on the Rochester level. The State has a free hand whereby it may apportion such surplus as it will to hydraulic uses on the Rochester level and either for public use or to be granted for private use at sites where the State may secure the most advantageous returns. Settlement of that matter and of the question arising under the deed of Letchworth park, should precede more definite action for regulation of the Genesee river flow by flood storage.

#### A STATE WATER LAW AND STREAM SUPERVISION NECESSARY.

The practices, some of long standing in the Genesee watershed, by way of unauthorized diversion of public waters and of unlawful, as well as dangerous, invasion of stream channels, shown in this report, is largely the result of absence of supervision of these waters and channels and of any adequate code of State water law. These general practices are not confined to the Genesee watershed. A well settled and highly organized State, possessing such extensive waters as New York, must not expect without such care, to secure the public safety and protect the

public right in waters. Court decisions are not an available source for supplying the everyday needs of the business community with information to guide it in these matters. Along with active supervision over all our public waters, outside the canal system, should be provided adequate authority in the Conservation Commission to make grants of such privileges as may properly be given, for special uses. In no other way may legitimate public needs be lawfully served and illegal uses and private appropriations of public water and channels terminated or prevented.

Respectfully submitted,

GEORGE E. VAN KENNEN,,

*Chairman,*

JAMES W. FLEMING,

JOHN D. MOORE,

*Conservation Commissioners.*

## CONSERVATION DEPARTMENT.

*Statement of Expenditures for the Fiscal Year Ending  
September 30, 1911.*

### DIVISION OF FISH AND GAME.

#### *Propagation and Distribution of Fish:*

For maintenance of hatcheries and collection and distribution of fish and fry . . . . .	\$64,078 35	
For repairs and improvement of hatcheries . . . . .	8,309 07	
For collecting and purchase of fish eggs	2,348 32	
For miscellaneous expenses, fish car, etc. . . . .	410 16	
For fish culturist's salary and expenses.	3,609 41	
	<hr/>	\$78,755 31

#### *Protection of Fish and Game:*

For salaries of chief protector, assistant and division chiefs, game protectors and clerk . . . . .	\$84,404 51	
For payment of moieties, justices, constable, attorney, witness and court costs . . . . .	23,987 49	
For purchase and maintenance of steamboats and launches . . . . .	6,953 27	
For printing game law summary . . . . .	41 44	
For printing hunters' licenses . . . . .	2,110 00	
For traveling expenses of chief, assistant chiefs, division chiefs and protectors . . . . .	39,054 96	
For extra expenses of protectors and special protectors . . . . .	3,192 44	
For salaries and maintenance expenses of game bird farm . . . . .	5,262 36	
For services and expenses of hunters' license bureau and fees and expenses of county clerks . . . . .	2,832 09	
	<hr/>	167,838 56

*Marine Fisheries Bureau:*

For salaries of superintendent, deputy superintendent, engineer, clerks, three fisheries and two Jamaica Bay protectors . . . . .	\$15,929 20	
For expenses of superintendent, deputy, engineers and protectors . . . . .	3,498 69	
For rent of office, postage, stationery and general office expenses . . . . .	3,075 35	
For surveying, plotting and monumenting shellfish lands . . . . .	161 00	
For expenses of shellfish commissions convention . . . . .	30 62	
	<hr/>	\$22,694 86

## DIVISION OF LANDS AND FORESTS.

For salaries of superintendent of forests, assistant superintendent, foresters, inspectors, fire superintendents and clerks . . . . .	\$28,368 56	
For surveying, witness, court and attorneys' costs in defending State's title to land . . . . .	4,717 01	
For rebates paid towns for fighting forest fires and salaries and expenses of fire patrol, telephone lines and observation stations . . . . .	72,395 30	
For reforesting burned and denuded lands in the forest preserve and the maintenance of nurseries for the propagation and distribution of seedling trees . . . . .	23,381 55	
For land purchased in the forest preserve and expenses of inspecting, attorney fees, recording, etc., Adirondack park . . . . .	7,807 90	
Catskill park . . . . .	3,187 08	
For repairs to John Brown homestead . . . . .	226 25	
	<hr/>	
Brought up . . . . .		\$140,083 65

Amount forward . . . . .	\$140,083 65	
For services and expenses of stereopticon operator in connection with lectures on forestry . . . . .	1,492 20	
For repair of docks and pavilions and care of grounds, St. Lawrence Reservation . . . . .	201 36	
For map of Catskill preserve . . . . .	1,201 50	
For traveling expenses of superintendent of forests, assistant superintendent, foresters and employees . . . . .	6,961 75	
	<hr/>	\$149,940 46

## DIVISION OF INLAND WATERS.

(Water Supply Commission.)

*Genesee River Improvement:*

Salaries of engineers and assistants . . . . .	224 52
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*General Office Expenditures:*

Salaries of commissioners . . . . .	\$20,161 30	
Salaries of officials and employees . . . . .	8,892 53	
Expenses of commissioners . . . . .	1,826 08	
Expenses of officials and employees . . . . .	460 74	
General office expenses . . . . .	2,547 66	
Rent of offices . . . . .	916 66	
	<hr/>	34,804 97

*Water Power and Storage, Surveys and Investigations:*

Salaries of engineers, etc. . . . .	\$22,902 01	
Rent, equipment and general expenses . . . . .	12,190 58	
	<hr/>	35,092 59

*Surveys and Investigations under State Boards and Commissions:*

Salaries of engineering force . . . . .	\$10,909 97	
Miscellaneous expenses, travel, equipment, etc. . . . .	2,500 01	
	<hr/>	13,409 98

MISCELLANEOUS.

Salaries of commissioner and deputy commissioner (Forest, Fish and Game).....	\$7,081 00	
Expenses of commissioner and deputy commissioner (Forest, Fish and Game Commission). ....	847 04	
Salaries of conservation commissioners, deputies, secretary, counsel and engineers . . . . .	9,121 52	
Salaries of secretaries, agents, stenographers, clerks and employees.....	15,514 77	
Traveling expenses, conservation commissioners and employees.....	374 47	
Louis Marshall, claim services.....	2,518 45	
Legal department salaries.....	9,967 81	
Legal department expenses.....	1,173 38	
Legal department rent.....	291 67	
General office expenses, printing, postage, equipment, transportation, rent, etc. ....	9,037 55	
		\$55,927 66
Total . . . . .		<u>\$558,688 91</u>



**SUMMARY OF RECEIPTS AND DISBURSEMENTS FROM  
VARIOUS SOURCES EXCLUSIVE OF REGULAR AC-  
COUNTS WITH THE STATE COMPTROLLER FOR  
THE FISCAL YEAR ENDING SEPTEMBER 30, 1911.**

*Receipts:*

From fines and penalties collected...	\$34,334 19	
From trespasses on State land.....	16,712 74	
From setting forest fires.....	340 00	
From failure to lop trees.....	3,738 30	
From rentals of shellfish lands .....	24,034 62	
From sales of seedling trees.....	6,821 25	
From rebates on fire bills paid by State	4,626 99	
From sales of hunters' licenses.....	\$156,005 60	
From sales of net licenses.....	10,048 44	
From sales of bird licenses.....	5 00	
From sales of breeders' licenses .....	25 00	
From refunds from various sources...	437 17	
From miscellaneous receipts.....	1,097 35	
		<hr/>
		\$258,226 65

*Disbursements:*

By moieties paid complainants in ac- tions .....	\$882 77	
By justice, constable, court and witness costs .....	775 05	
By cash paid State Treasurer.....	256,568 83	
		<hr/>
		258,226 65
		<hr/> <hr/>

## CANASERAGA CREEK IMPROVEMENT FUND.

*Receipts:*

\$200,000 of 5 per cent. bonds sold...	\$200,000 00	
Premium on same .....	6,260 00	
		<hr/>
		\$206,260 00
Accrued interest .....	\$1,833 33	
Interest on bank balance to October 1, 1911 .....	6,315 04	
		<hr/>
		8,148 37
		<hr/>
		\$214,408 37

*Disbursements:*

Engineering and legal services.....	\$9,242 36	
Miscellaneous expenses .....	2,466 54	
Construction contractor .....	2,701 79	
Interest on bonds .....	10,000 00	
	<hr/>	24,410 69
Balance in bank .....		<hr/>
		\$189,997 68
		<hr/>



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